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DIESEL RAILWAY TRACTION

A Supplement illustrating and describing developments in Diesel Railway Traction is presented with each copy of this week's issue.

One Hundred Years of Weekly Publication

TWO and a half years ago THE RAILWAY GAZETTE and its constituent journals completed 100 years of continuous publication and duly marked the occasion by the inclusion (in our issue of May 3, 1935) of a centenary article. *Herapath's Railway Journal*, our oldest constituent, was started in William IV's reign as a monthly publication, and it was not until Queen Victoria had ascended the throne that the first boom in railways took the turn of speculation. No longer was a monthly publication sufficient to record the frequent fluctuations of the stock markets, and on Sunday, October 29, 1837, number one of a new paper called *The Railway Times* made its appearance. Incidentally, the event was recorded in Hamburg as the inauguration of *Der Eisenbahn Times* of London. At first it was produced at 6d. a copy in the size and form of a popular newspaper, its page being about 15 in. by 20 in., and, as indicated in its first leader which we reproduce in our Scrap Heap columns this week, the original intention was to produce a general weekly newspaper with a railway bias, rather than exclusively a specialised journal. Nevertheless, its appearance was the first link in a continuous chain of weekly publication of journals avowedly dealing in the main with railway transport, and since *The Railway Times* is one of the constituents of THE RAILWAY GAZETTE we feel justified in hailing today as our centenary of weekly publication. *The Railway Times* soon found that it was unadvisable to attempt mixing the requirements of a specialised newspaper with those of a Sunday newspaper, and beginning with its issue of January 13, 1838, it adopted Saturday as its publishing day and assumed the familiar quarto size.

* * * *

General Managers

With the modern tendency towards centralisation of power, exemplified by the growth due to amalgamations of industrial organisations, the responsibilities of chief executive officers become progressively greater. As Lord Horne said in his presidential address (reported on another page) to the Railway Students' Association last week, a general manager has an extraordinary series of duties to perform. Among those he mentioned specifically was that he should have sufficient technical knowledge to enable him to talk authoritatively with the heads of various departments; and another essential quality is, of course, the ability to delegate authority in such a way as to stimulate initiative and a sense of responsibility right down through the ranks of the staff from chief officer to manual worker. We publish in this issue two messages to the staff of the Southern Railway, one from the outgoing General Manager, Sir Herbert Walker, the other from his successor, Mr. Gilbert Szlumper. The latter pays a high but just tribute to the author of the former and is itself a tribute to the new General Manager. Mr. Szlumper's message to the staff provides evidence to his outstanding qualities for the new task that has fallen to his lot, and a long personal acquaintance with him confirms our faith in the future efficient conduct of the Southern Railway.

* * * *

The Week's Traffics

Passenger train and merchandise traffics each contributed amounts of £60,000 and coal traffics £46,000 towards the total increase of £166,000 in the receipts of the four main companies for the past week. This total compares with an increase of £147,000 for the previous week and one of £135,000 for the week before that. For the year to date the four companies together have received £133,084,000, an increase of £5,585,000 or 4·38 per cent. The passenger train traffics of £60,305,000 are up £2,460,000; merchandise earnings (£45,902,500) are £1,419,500 better; and the coal receipts of £26,876,500 have improved by £1,705,500.

	42nd Week				Year to date	
	Pass., &c.	Goods, &c.	Coal, &c.	Total	Inc. or Dec.	
	£	£	£	£	£	%
L.M.S.R. ..	+ 28,000	+ 24,000	+ 19,000	+ 71,000	+ 2,083,000	+ 4·04
L.N.E.R. ..	+ 20,000	+ 20,000	+ 21,000	+ 61,000	+ 1,796,000	+ 4·81
G.W.R. ..	+ 5,000	+ 15,000	+ 9,000	+ 29,000	+ 1,097,000	+ 5·13
S.R.	+ 7,000	+ 1,000	− 3,000	+ 5,000	+ 609,000	+ 3 53

Mersey Railway receipts to date are £175,799, an increase of £5,216.

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Coal Traffic Prospects

The importance of coal traffic to the railways makes of particular interest a review of the present situation in the coal producing industry which appears in the current issue of the *P.D. & G.L.M. Review*, the house organ of the Powell Duffryn group. In this it is stated that lower outputs during the holiday season just ended have accentuated the shortage of many descriptions of coal, and with the seasonal increase in home demand, the coal market appears likely to show greater strength for the remainder of the year than at any period since the present improvement began. Many collieries are already fully sold, and

there is thought to be little probability of such an increase in production as would be likely to yield any surplus for some time to come. A further noticeable feature is the determination of buyers to book their requirements for 1938. Sales for delivery over next year are already in excess of the quantity usually sold at this period of the year, and, in fact, the tonnage sold in this respect is greater this year than has been the case for many years past. The increases in railway rates which came into operation on the first day of the present month have to be borne by producers upon the contract coals which were sold at the market prices ruling towards the end of last year. These railway rates increases are but one of many items in the total costs of production and distribution which have risen recently, and account for only a small percentage of the higher charges that may result in substantial losses upon much of the coal now being delivered. Increasing costs of production are held to account to a very large extent for the meagre profit shown in the results of several of the coalfields during recent accounting periods, and these figures are, of course, unaffected by the new railway rates, which have been in force for less than a month.

* * * *

Permanent Prosperity

At a time of panic and pessimism Lord Horne's speech last Monday in replying to a welcome extended to him by the Lord Mayor of Cardiff, is encouraging. He referred to the changed conditions at the Cardiff docks since his last visit two years ago. Then the docks were nearly empty; now activity is apparent everywhere. Shipments of coal and general commodities are going up, and so far this year 3,000,000 tons more coal have been shipped than in the corresponding period of last year. Speaking of the general position, Lord Horne said that so far as Great Britain was concerned he saw no reason why we should not look forward to a long period of prosperity despite anything that happened in other parts of the world. From so responsible an authority these are encouraging words. The source of all prosperity is markets ample enough to absorb the product of industry, and it is the insufficiency of these that has hitherto caused the restriction of production which has been the bane of producers not only in their capacity as such but in their other capacity as consumers lacking sufficient purchasing power.

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A Recording Pioneer

The series of articles on Railway Maintenance Problems that we published during 1935 caused such widespread interest that their author, Lt.-Col. H. A. Hull, was subsequently in demand for consultation particularly in regard to the treatment of earth slips, of which he had made a special study. Now we have regretfully to record Colonel Hull's death, but he has left his mark behind not only in the form of the published record of his experiences—subsequently reprinted as a book—but by the excellence of his practical works. He was a man with an original mind and an observant eye and profited by his varied experience, first on the old London & North Western Railway and latterly with its successor, the L.M.S.R. In his later days as a maintenance engineer he had the benefit of his early experience in charge of varied new works, and throughout his career had referred all new problems to first principles thereby achieving successful results with the minimum of trial and error. No better epitaph could be found for him than the words with which he introduced his series of articles: "Notwithstanding all the knowledge now available in print, some of the most essential and elementary facts are often ignored. There are always pioneers at work, on whose heels follow those with ingenious minds to record their results as formulæ for the future guidance of the unimaginative or timid." Colonel Hull was a true pioneer who eventually recorded for the future guidance of others the results of his own experience.

* * * *

Assam Railways and Trading

This company possesses in the north-east of Assam metre gauge railways of 113 miles, which the Government of India has the right to purchase in 1941 or any tenth year thereafter, and a colliery line of 29 miles. Colliery and other trading rights, and holdings in two tea companies and in the Rivers Steam Navigation Co. Ltd. also form part of the undertaking. The rolling stock consists of 32 locomotives, 71 coaching vehicles, and 1,397 goods vehicles, and during the financial year ended March 31 last, on which the report has now been issued, the company purchased two motorbuses. Railway earnings during the year under review dropped from £143,246 to £133,287, in the working expenses of £88,693 there was a saving of £481, and the profit on railway working was £44,594, against £54,072. The amount of coal sold improved from 181,527 tons to 197,830 tons, but coal earnings were slightly lower. Revenue from trading as a whole was £34,375, against £33,884, and the net amount received in dividends and interest on investments improved from £4,990 to £10,229. Dividends on the pre-preference 8 per cent. A shares and on the new 6 per cent. preference shares are again being paid in full, leaving £47,358 to be carried forward, against £47,237 brought in.

* * * *

Improving Outlook in Argentina

Sir Follett Holt, speaking at the meeting on Wednesday of the Buenos Ayres Great Southern Railway (see page 746), addressed a special message to shareholders discouraged by past adversity. During the year, he said, their railway had handled a volume of business which, measured in ton-miles, constituted a record in its history. Theirs was a very virile undertaking, with only one trouble, a major one it was true, namely, that it did not at present receive a living wage for its services. Of its virility, Sir Follett Holt gave a survey in his account of recent enterprise in acceleration and the acquisition of modern equipment. This company and the Buenos Ayres Western, with which its working is combined, have on order 100 diesel railcars of which delivery will begin in a few months' time. As to the possibility of earning a living wage in face of exchange and other difficulties, the Chairman was not without hope that the increasingly favourable balance of trade might induce the Argentine Government to relax its control of exchange. The new Argentine President, who assumes office early next year, is the former Minister of Finance, and his successful work in that position augurs well for the future.

* * * *

The "Blue" Train on the Bakerloo

The use of colours as an adjunct to the printed notice for the guidance of passengers to the different trains and routes on the London Underground railways is an obviously useful expedient, and as far as the regular traveller is concerned the present arrangements will surely admit of little improvement. The occasional traveller and the foreign visitor are not so easily dealt with, and their every step must be guided. Despite clearly-printed directional signs and distinctive colours, the Underground still has terrors for the stranger, who, after mastering his fear of the escalator, is still faced with the dread possibility of finding himself in the wrong train. As a case in point

we have particularly in mind the Harrow and Watford service on the Bakerloo Line. This service is run by the so-called "blue" train (with the usual red and buff colouring but with a blue stripe along the upper panel), but a "red" train, with no blue stripe, maintains an alternate service to Queens Park station only. The directions at Piccadilly Circus and other central stations, guiding the passenger to certain platforms for the Harrow and Watford line, make no mention of the colour distinction, nor is there any illuminated sign on the platform itself to indicate the destination of the train. There is the possibility therefore of the Harrow passenger getting into the "red" train, which goes no further than Queens Park, and if he does not hear the warning "all change" given perfunctorily at that point, he will be carried on to the carriage shed and thence back to the Up line, a distressing mistake that has already been known to happen. This possibility could be avoided by the provision of illuminated indicators, as on the District Line stations and those of the Northern tube, with a loudspeaker at Queens Park to announce the change of train. Suitably coloured indicators "Red trains Queens Park only" might be posted in the approaches and escalators, and on the route diagrams in the carriages.

* * * *

The Science Museum, South Kensington

In 1910 the Government appointed a committee to consider building a museum dealing with scientific discovery and the application of science to industry. This committee recommended that three blocks of buildings should be erected, the first to be started forthwith (1912), and the others to follow as soon as the first block was ready for occupation. The block which at present houses the Science Museum was not completed until 1928 and unfortunately the other blocks have not been begun. As a consequence, not only is there acute congestion in the present block, but many articles are in store which should be exhibited. There are also many additions still to be acquired if the collection is to constitute a satisfactory record of the various branches of science and industrial development up to the present day. Additional space is also needed for holding special temporary exhibitions showing trade uses to which manufactured products are being put. The advisory committee of the museum now feels that even the total space provisions recommended by the 1910 committee would be inadequate to meet immediate or future needs, and proposes to recommend to the Government that the whole of the site bounded by the Eastern wall of the existing museum, and by Exhibition Road, Imperial Institute Road, and Queens Gate be finally allocated to the Science Museum. As recorded in a news paragraph on page 743, the Federation of British Industries has signified its support of the proposal, and it is to be hoped that the Government will see its way to adopting the recommendation.

* * * *

More Double-wire Points on the G.W.R.

The abolition of signal boxes and the concentration of the working in a smaller number wherever possible, especially at those places where more than one was required by the old regulations governing the distance at which points might be worked, has been the order of the day during recent years. Numerous schemes have been carried out, and all have produced considerable savings. The long distance point operation rendered necessary has been effected in various ways, but generally by means of some electric motor mechanism. Mechanical operation by double wires, a method in general use in several Continental countries, has also been used to some extent, suitably arranged to work British equipment, with plunger facing-point locks and non-trailable points. Having obtained satisfactory results with it at several places in the South Wales area, the Great Western selected it for the interesting installation at Johnston, described on page 729, where the points at the actual junction, formerly worked by the West signal box, are now connected to a group of eight double-wire levers, placed between others of ordinary type in the new locking frame in the former East box. Such a combination appears admirably adapted to the requirements and it seems likely that other examples will be seen as time goes on.

* * * *

Metallurgical Aspect of Air Resistance

In a highly interesting paper read at a meeting of the American Society of Mechanical Engineers, and since reported in the *Transactions* of that body, Mr. A. I. Totton, dealing with the resistance of lightweight passenger trains, devoted considerable attention to air resistance. This, as he said, in effect covers not only head end resistance, but all air elements including those pertaining to such factors as turbulent or eddy currents, skin friction, ground wind, and viscous drag. It is generally assumed that such resistance varies as the square of the speed, which although not entirely true, is sufficiently accurate for all practical purposes. The formulæ introduced some ten years ago by Mr. W. J. Davis, an engineer of the General Electric Company, apparently took cognisance of the fact that a more or less definite relationship existed between the cross-section, weight, and length of the individual coach units, which afforded automatic compensation for skin effects. Thus he used the head end area in combination with a proper constant for establishing total air resistance, and divided the result by the weight of the individual vehicles or the locomotive to obtain the unit resistance expressed in lb. per ton. The later use of aluminium and high-tensile steel alloys in railway coach construction disturbed the previously mentioned equilibrium, so that the principal authorities on this subject now deem it best to take the cross-sectional area or perimeter of the locomotives or carriages in combination with the length, for securing total air-resistance values.

* * * *

Names for All Trains?

A 55-mile service on which the majority of expresses are named is unusual enough, even were conventional principles to have been followed in selecting the titles. This can hardly be said of the names chosen for the Camden—Atlantic city trains of the Pennsylvania and Reading Railroads in the U.S.A., which systems are now collaborating in working the service over a common route instead of by their independent main lines as previously. Speed is the keynote of some of the names, such as The Shore Meteor, The Flying Eagle, and The Flying Cloud, but sometimes the more usual railway associations give place to a holiday spirit in keeping with the city to seaside service which the trains provide. The Barnacle Bill, and the Bosun's Mate, if they suggest a somewhat slow and rolling gait, are trains which the traveller can trust to take him away from the cares of city life. The very brave may commit themselves to The Twilight, The Mermaid, The Sea Nymph, and (prophetically) The Honeymooner. There are names to suit the tastes of every pebble on the beach. If this naming scheme proves popular, patrons of the Penn-Seashore Lines may soon ask for a similar distinction to be applied to their morning and evening suburban business trains. After The Beach Patrol, why not The Golden Breadwinner?

Buenos Ayres Western Railway

NOTWITHSTANDING the effects of unfavourable climatic conditions on the output of wheat and maize, which are the two main commodities transported by the Buenos Ayres Western Railway, gross receipts for the year ended June 30 last increased by £233,733 or 6·64 per cent., at an additional cost of only £50,138 or 1·72 per cent. in working expenses. The net receipts of £763,647 were thus higher by £182,594 or 31·42 per cent. But the sum of £299,487 had to be provided for exchange differences, an increase of £25,732 compared with the previous year. The average annual loss since the official depreciation of the peso in 1934 has been £307,787. If these exchange losses had been eliminated both the preference stocks would have regularly received their full dividends amounting to £129,855, and apart from renewals, amounts ranging from 0·82 per cent. to 2 per cent. would have been earned on the ordinary stock of £17,347,660. For the year under review the full dividend of £15,000 is to be paid on the 5 per cent. preference stock, and 3½ per cent., requiring £89,332, on the 4½ per cent. preference stock, leaving £29,561 to be carried forward against £33,205 brought in.

Passenger journeys advanced by 1,690,593 or 8·45 per cent., and passenger revenue by £67,820 or 9·08 per cent. In the suburban area the increase in journeys was 1,518,695 or 8·20 per cent., chiefly due to the reduced fares and the extension of validity of return tickets introduced on March 1, 1936. Main line journeys increased by 174,356 or 12·17 per cent., principally because of greater commercial activity, the reduction of fares and extension of validity of return tickets as far out as Chivilcoy which was put into force on March 1, 1936, and the modified system of season-ticket rates from certain stations outside the suburban zone which was introduced on December 1, 1935. One-class diesel railcar services were instituted during the year under review between Lincoln and Bragado, and Lincoln and Villegas, and the Once—Pehuajo evening first class diesel railcar service ran throughout the year with great success. Public goods traffic increased by 213,890 tons or 10·83 per cent., producing receipts which were higher by £80,878 or 5·17 per cent. Tonnage of general merchandise increased by 14·01 per cent. and the receipts therefrom by 10·27 per cent. Better commercial conditions were largely responsible for this improvement, and the reduced rates to combat road competition introduced on May 1, 1936, between Buenos Aires and stations within a radius of 250 kilometres also helped to produce a recovery in tonnage. Some comparative operating figures follow:—

	1936–37	1935–36
Passenger journeys	21,690,952	20,000,359
Tons of goods	2,188,343	1,974,453
Average goods haul, km.	217	237
Train-kilometres	9,085,784	8,830,337
Operating ratio, per cent.	79·56	83·41
	£	£
Passenger receipts	814,514	746,694
Goods receipts	1,644,492	1,563,614
Gross receipts	3,735,632	3,502,899
Working expenses	2,971,985	2,921,846
Net receipts	763,647	581,053

Important internal changes in the merged administration of the Southern and Western Railways were brought into force at the beginning of the year. In order to avoid the inconvenience of divided responsibility for locomotive maintenance, running sheds were transferred from the Operating Department to that of the Chief Mechanical Engineer. Simultaneously certain functions such as the loading of wagons and cleaning of coaches were transferred to the Operating Department from the Traffic Department. Successful efforts are being made in the direction of maintaining close contact with clients of the railway throughout the districts served. In accordance with the Presidential award, wage retentions were made from the salaries of the staff during the months of July and August, 1936, but as the net figures improved, they were suspended as from September 1 and have been refunded.

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Buenos Ayres & Pacific Railway

ON the operating side the results obtained by the Buenos Ayres & Pacific Railway during the financial year ended June 30, 1937, were distinctly satisfactory. For the third year in succession since the trough years of depression 1932-33 and 1933-34, a substantial increase over the previous year's receipts is shown. In the year under review the increase in receipts was £697,276 or 10·68 per cent., and this improvement was secured with an advance of only £322,044 or 6·22 per cent. in working expenditure, so that net receipts were higher by £375,232 or 27·79 per cent. Much of this advantage was, however, neutralised by the loss on exchange due to the official depreciation of the peso, which loss amounted in the year under review to £752,348, against £710,059 in the previous year, £803,061 in 1934-35, and £850,217 in 1933-34. Representations are being made to the Argentine authorities in the hope that some alleviation of the exchange burden or some increase in income will be allowed. The company has been able during the year to make full interest payments at the due dates on its own first debenture stocks and on those of the Argentine Great Western, and the Villa Maria & Rufino Railways, and on the Pacific and the Great Western second debenture stocks, making a total of £373,315. In addition, three payments each of one half-year's interest on account of arrears were made in December, March, and July last on Pacific 4½ per cent. debenture stock and on Great Western 5 per cent. debenture stock, totalling £945,030. The total debit balance is now £4,791,546.

Receipts from passenger traffic show an increase of £79,265 or 10·37 per cent. An improved service of trains on the Buenos Ayres local section and combination with the Lacroze underground line produced an addition of 675,000 passengers, or 34½ per cent., and long distance travel increased by just over 10 per cent. In goods traffic there was an advance of 578,237 tons or 17·11 per cent., with an increase in receipts of £545,477 or 11·57 per cent. Receipts from cereals were up £192,110, and in wine traffic there was an increase of 10·43 per cent. in tonnage and of £198,869 (11·39 per cent.) in receipts. Some operating figures are compared in the accompanying table:—

	1936–37	1935–36
Passengers	13,201,942	11,320,627
Tons of goods (metric)	3,956,998	3,378,761
Train miles	9,416,558	8,583,975
Net profit per train-mile	3s. 8d.	3s. 1¾d.
Operating ratio, per cent.	76·13	79·32
	£	£
Passenger receipts	843,510	764,245
Goods receipts	5,260,350	4,714,873
Gross receipts	7,226,550	6,529,274
Working expenses	5,501,273	5,179,229
Net receipts	1,725,277	1,350,045

Increased operating costs were to be expected in view of the additional work performed. Moreover, except for short-time working, full salaries and wages were paid during the whole of the year as against seven months in the previous year. Short-time working itself was also reduced

by 50 per cent. by reason of exigencies of work in the shops. These factors brought the total increase in staff costs to £185,000. As from July 1, 1936, a modified system of accounts was put into operation, jointly with the other broad-gauge railways, which has necessitated a considerable number of changes in methods of appropriating expenditure. Working expenses for the year included £250,000 as a further provision for deferred renewals.

* * * *

Canal and Coastwise Shipping Rates

IN addition to making important proposals regarding the stabilisation of road rates, the Transport Advisory Council's Report on Services and Rates (reviewed in our issue of October 22) also dealt with the stabilisation of rates for the conveyance of goods by canals and coastwise shipping. The report records that the Committee of Investigation examined the principles underlying the road-rail proposals to ascertain how far they could be applied to other forms of transport, with the object of devising a general scheme of co-ordination. So far as canals are concerned, the committee considered that the most profitable line of development was to apply a system which, after providing for the protection of traders' interests, would give legal sanction to voluntary rates agreements in that industry. The canal interests, which already have in existence a large number of agreed rates covering a wide variety of traffics, proved willing to accept the principle of a compulsory rates structure, to be achieved by giving legal sanction to voluntary agreements. Accordingly, the committee proposed, and the council approved the suggestion, that a Canal Rates Tribunal should be set up for the purpose of confirming, with or without modification as circumstances might require, the proposed rates. The council recommends that this canal rates structure should extend to statutory waterway proprietors who are carriers, and companies owning fleets who provide carrying services for hire or reward; but the position of those carriers who own and work their own craft was reserved for further consideration. The canal interests also agreed that a compulsory rates structure would involve the recognition of a fair wage obligation, but it was not felt that there was any necessity to impose a licensing system to secure the enforcement of a rates structure in the case of canals, or that provision need be made for the appointment of area canal rates officers in view of the much greater stability of canal rates and the relatively small number of carriers involved.

With regard to coastwise shipping it is pointed out that this industry differs in many respects from road, rail or canal transport, and the committee is not able to make any definite proposals until it has had an opportunity of making further investigations. In particular it proposes to consider whether the adoption of a statutory rate control for coastwise liner shipping would strengthen the position of such interests *inter se*, or advance co-ordination between the various goods transport services; the committee also recognises the inherent difficulties in endeavouring to operate a rates structure in the coastwise tramp trade. Further time is also required for the study of the statements made by the representatives of the coastwise shipping industry regarding the alleged harmful effect of road and rail competition upon their branch of transport. The council fully recognises the importance of the industry, both from the trading and national point of view, and is anxious to take no step which would affect it detrimentally. The measure of agreement already reached between road, rail, and canal interests is a good augury for the future work of the council, and both traders and transport organisations will await with interest an indication of the extent to which the Minister of Transport is prepared to implement the recommendations.

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London Transport Report

LIKE its predecessors the fourth annual report and accounts of the London Passenger Transport Board, covering the year ended June 30, 1937, has a handsome orange-red cover. It includes four maps—railway, bus, coach, and tram-trolleybus, a graph showing passengers originating on each form of transport during the year, several photographic illustrations, a plan of Chiswick works—layout and extensions, and a graph showing the relative intensity of noise audible to passengers in tube trains under given conditions. The Coronation attracted large numbers of people to London, and but for the strike which resulted in the complete withdrawal from service of all the buses in the Central area from May 1 to 27 inclusive, covering the whole of the Coronation period, the passengers carried would have shown a considerable increase over the previous year. As it was, the number of passengers originating on the board's services during the period of the strike was 192,000,000 as compared with 278,000,000 in the corresponding period in the previous year, in spite of 68,000,000 more passengers carried during the strike period by the board's railway, tram, trolleybus, coach, and country bus services.

Notwithstanding the strike, the financial results for the year were better than those of previous years. Under the pooling scheme the board shared in the special Coronation traffic of the main line railways, a good deal of which was diverted from the buses to them. Furthermore, a major part of the central bus expenses which continued during the strike was covered by allowances from the pool. The board expresses its satisfaction with the efficiency, good humour, and goodwill shown under conditions of great pressure by the staff of other sections of the undertaking. In the four weeks following the strike the receipts of central buses averaged only £270,527 a week, against £282,956 a week in the four weeks preceding the strike. Evidently the strike not only gave a stimulus to the use of other forms of transport, but induced people to take to walking. It also effected some permanent shifting of traffic to the underground and main line railways. Another result of the strike was a compulsory redistribution of the passengers travelling to and from work over more extended hours in order to relieve congestion. In the year under review the percentage of passengers using buses and coaches was 55, against 58 in the previous year, tram passengers were 25 per cent., against 27 per cent., railway passengers 14 per cent., against 13 per cent.; and trolleybus passengers 6 per cent., against 2 per cent. The latest developments regarding trolleybuses were recorded in THE RAILWAY GAZETTE of September 24 last at page 521.

Receipts from passengers under the pooling scheme are shown in the accompanying table:—

	1936–37	1935–36
	£	£
Passenger receipts originating on—		
Railways (L.P.T.B., G.W.R., L.M.S.R., L.N.E.R., S.R., and Joint Lines) ..	19,629,815	18,499,092
Buses and coaches (L.P.T.B.) ..	15,217,707	15,959,445
Trams (L.P.T.B.)	5,260,300	5,719,103
Trolleybuses (L.P.T.B.)	1,270,107	428,699
	41,377,929	40,606,339
Average receipt per passenger journey	2·347d.	2·312d.

The board's share of these receipts, after operation of

the pooling scheme, amounted to £30,077,161 in 1936-37, against £29,532,879 in 1935-36, £28,823,262 in 1934-35, and £27,151,277 in 1933-34. To these sums have to be added goods and miscellaneous traffic receipts, and the general financial results of the board's operations are shown in the following table:—

	1936–37	1935–36
	£	£
Capital expenditure	123,777,419	118,088,715
Total traffic receipts	30,247,378	29,724,723
Working expenses	23,917,085	23,515,821
Provision for renewal	2,400,000	2,300,000
Net traffic receipts	3,930,293	3,908,902
Other receipts	1,623,539	1,563,214
Miscellaneous charges	293,779	298,077
Net revenue	5,260,053	5,174,039
Transfer from C stock interest fund ..	30,843	28,632
Interest on London Transport stocks other than C	4,080,447	4,080,447
C stock interest	1,092,199	1,027,952
Other appropriations	118,250	94,272

Amongst "other appropriations" in 1936-37 are included £28,061 to C stock interest fund and £72,119 net to the London Electric Transport Finance Corporation Limited. The operating ratio for 1936-37 (excluding provision for renewal) is 79 per cent., the same as in the preceding year. Interest paid on C stock was 4¼ per cent. for the year under review, against 4 per cent. for the previous year.

Some three out of the four miles of new tube tunnels between Baker Street and Finchley Road have been constructed, together with the station tunnels at Acacia Road, Swiss Cottage, and Baker Street. Work has been started upon the bulk of the Central Line extensions, but progress is restricted owing to the difficulty of obtaining adequate supplies of iron and steel. Amongst works not commenced or in abeyance are the two-mile extension from Elephant & Castle to Camberwell, two miles of the nine-mile extension of the Central Line from Liverpool Street to Newbury Park, and widenings and additions Harrow to Rickmansworth, nine miles.

* * * *

Locomotive Boiler Proportions

IT is fortunate that our publication in the present issue of an authoritative article by Mr. E. C. Poultney on "The Firebox Proportions of Modern Locomotive Boilers," should almost coincide with a paper read on Wednesday last, at a meeting of the Institution of Locomotive Engineers in London, on the same subject. By common consent, the boiler is accepted as the basis on which a locomotive design is planned, for without efficient boiler performance, the engine cannot possibly operate to advantage; in other words, when it comes to getting the maximum possible output from a locomotive, the matter is essentially a boiler problem. In the paper referred to, "The Proportions of Locomotive Boilers," the author, Mr. A. F. Webber, pointed out that although the locomotive, regarded as a power plant, may prove to be a very efficient machine, it may quite easily, and at the same time, be an unsatisfactory traffic unit, and he cited certain instances in which this had proved to be so. Clearly the ideal locomotive is one which can perform its regular work with precision and efficiency, but which also has an overload capacity at reduced, but not too much reduced, efficiency. The effect of front-end design on maximum output is chiefly that the more efficiently the steam is used, the greater effective output can be produced from a given maximum evaporation.

The design of the boiler as applied to a locomotive, is far more stringently restricted by space limitations than in any other of its numerous applications, and it was for this reason that the author considered boiler design to be the key for the future development of the steam locomotive. There are many factors which have to be closely considered in appraising the value of locomotive boiler design. An arrangement of the boiler tubes—for example long tubes of small bore—may give a boiler operating with a high thermal efficiency, but perhaps the accompanying vacuum in the smokebox will not create sufficient draught in the firebox for the combustion of coal at an adequate rate. Where such boilers have been designed and built, it is necessary to sharpen the blast either by restricting the exhaust nozzle, or by working with a partly closed regulator and a late cut-off, giving a high cylinder release pressure. Neither of these expedients is economical, but the real weakness of the design is the inability to produce enough steam for hauling heavy loads. It is clear that to maintain boiler evaporation, the tube system must be so designed that it will not absorb too much of the smokebox vacuum for propelling the gases along the tubes. The firebox grate area is also closely associated with good steaming qualities, since a high rate of firing per sq. ft. of grate area requires a greater draught in the firebox to induce the enormous volumes of air through the fire bed. The grate area also affects the boiler efficiency very considerably, since one of the most serious sources of heat loss is the loss of solid unburnt fuel, and this increases rapidly at high ratings. Importance also attaches to the lay-out and size of the superheater elements as forming an essential part of the route traversed by the steam on its way to the cylinders. The weight of the boiler and the increase in steam pressures also rank as primary factors.

The author devoted some attention to the over-cylindering of locomotives. At first sight, the disadvantages of large cylinders may seem small, since the larger the cylinders, the earlier can be the cut-off for a given total power output. It is true that oversized cylinders increase radiation, condensation and mechanical losses, but these, though affecting efficiency in the end, are not sufficient to account for the unsatisfactory performance of many boilers where the cylinders seem to be too large. The chief operating defect in such a case would appear to be the fact that with large cylinders and early cut-off, the release and back pressures are low, and the blast insufficient to generate the steam for the cylinders. The effect, therefore, is not that a more or less fixed quantity of steam is available, and that cylinders of a certain size can use this quantity to the best advantage, but that too efficient use of the steam may result in insufficient draught-producing power to raise the necessary amount of steam, unless the boiler is exceptionally free in steaming.

Although primary importance must be given to the general effectiveness of the locomotive in service, thermal efficiency is by no means negligible as a factor affecting the total railway working costs. Test results obtained in America have shown fairly conclusively that the efficiency of heat transmission in the locomotive boiler remains remarkably constant, whatever the rate of firing, and that the decrease as this rate is increased is due primarily to the combustion efficiency falling, as a greater proportion of the coal escapes unburnt; it is for this reason that so little divergence is shown between the efficiency curves for different locomotives when applied to the same basis of coal fired per sq. ft. of grate area per hr. Considerable ground was covered by the author in his paper, and in dealing with possible developments in locomotive boiler design, he suggested that it might be advantageous if a greater proportion of the air for combustion could be supplied over the fire bed, especially at high rates of combustion.

PUBLICATIONS RECEIVED

The Railway Age. By Cyril Bruyn Andrews. London: Country Life Limited, 20, Tavistock Street, Covent Garden, W.C.2. 10 in. × 7½ in. 145 pp. + 82 illustrations on art plates. Price 12s. 6d. net.—As a collection of early railway illustrations—many of them scarce and fascinating—this volume is an outstanding production, and we feel it is thus that it will be appreciated by both the railwayman and the interested layman. The text matter is modestly and accurately described in the foreword as an introduction to the study of early British railways, and of the various reactions that followed, intended to give an appetite for further interest in the subject rather than in any way to be complete in itself. The author shows himself possessed of a wide knowledge of the social effects of the introduction of railways, and his twelve chapters—always non-technical and often trivial—succeed in conveying in easy style a true picture of the enormous influence of railways on the life of the country. Only in the sphere of architecture and decoration does he show any special knowledge, but the purpose of the volume is not in any way impaired thereby.

The great care which must have been devoted to the collection and selection of the illustrations is wanting in the letterpress, where we are told within three pages that the Surrey Iron Railway was working in 1801 and was opened in 1805, neither of which contradictory statements is correct. "Robert Crookshank" in the text is more happily rendered as Cruickshank in the list of illustrations; *Augustus* Birrell strikes an unfamiliar note; and the old West Bridge (Leicester) terminus of the Leicester & Swannington Railway appears in strange guise to illustrate the homeliness of the country station at "Westbridge near Leicester." Fortunately the period of the book is too far removed from the present to cause any loyal resentment in the rendering of the Irish port as *Kingston*, and the modern Free Stater having reverted to Dun Laoghaire has no inducement to defend the spelling of the other name borne for a century by his port.

Of the illustrations it is difficult to be unjustly enthusiastic, for they constitute a finer collection than we have previously seen within the covers of one British publication. The discerning railway historian will not require to be told more than the fact that no fewer than 44 are acknowledged to the collection of John Phillimore. Other sources of pictures are the L.M.S.R., the L.N.E.R., the G.W.R., the Science Museum, the London County Council, the Darlington Art Gallery, and the Heal Collection in the St. Pancras Public Library. In all there are 82 illustrations on separate plates; 50 in the text; and a coloured frontispiece. Moreover, they are carefully listed and their sources indicated. This fine collection of reproductions is well worth the 12s. 6d. asked for the volume.

Tests of Steel Columns, Thin Cylindrical Shells, Laced Channels, Angles. Tests of Thin Hemispherical Shells Subjected to Internal Hydro-Static Pressure. Tests of Strength Properties of Chilled Car Wheels. The Combined Effect of Corrosion and Stress Concentration at Holes and Fillets in Steel Specimens Subjected to Reversed Torsional Stresses. Urbana, U.S.A.: University of Illinois Bulletins Nos. 292, 295, 294, and 293 respectively. Prices, 50 cents, 30 cents, 85 cents, and 50 cents respectively.—These form the latest batch of bulletins recording experiments carried out by the Engineering Experiment Station of Illinois University.

Modern Locomotives on the L.M.S. By D. S. Barrie. Issued with the authority of the London Midland and Scottish Railway by the Locomotive Publishing Co. Ltd., 3, Amen Corner, London, E.C.4. 8½ in. × 5½ in. 34 pp. + illustration plates. Paper covers. Price 1s. net.—It is difficult to imagine how Mr. Barrie could have been more economical of space without sacrificing comprehensiveness than he has been in the preparation of this brochure. This is no mere list of engine numbers and names, but an authoritative treatise on the locomotive policy of the largest of the four main-line railways in this country, since its formation at the beginning of 1923. As the author points out, the L.M.S.R. inherited no fewer than 10,316 locomotives of 393 different designs, and of wide variation in their degrees of modernity and efficiency. Striking evidence of the thoroughness with which the L.M.S.R. locomotive policy has been carried out is provided by the figures at the end of 1936; by that date the stock had been reduced by 2,625 to a total of 7,691, and the number of types had been brought down to 173, or a reduction of 220. The policy underlying these changes is set out by Mr. Barrie both lucidly and simply, and he covers all aspects of locomotive maintenance and operation, and not merely the efficiency of the unit when heading a train. Although Mr. Barrie has avoided tables of statistics, he has brought into his text many striking figures, not the least of which are those relating to double-heading. In this connection he tells us that during the years 1929-36 the introduction of more powerful and more economical types of engine has not only enabled a greater number of older engines to be withdrawn, but has also reduced by 25 per cent. (passenger) and 53 per cent. (freight) the double-headed mileage. A foreword by Mr. W. A. Stanier, Chief Mechanical Engineer of the L.M.S.R., confirms the authoritative nature of Mr. Barrie's information, and recommends the book, not only to locomotive engineers, but also to the numerous interested members of the general public. This recommendation we can endorse cordially.

Wiring Systems.—Callender's Cable & Construction Co. Ltd. has issued a new catalogue (No. 78) describing fully the cables, junction boxes, and accessories comprising the Callender wiring system. This system in its various forms is accepted as a standard by a very large number of installation engineers, consulting engineers, and architects in this country and abroad. This is the first time that full details of the system have been included in one catalogue. The addresses of the numerous branch offices of the company, where the cables and accessories mentioned may be obtained, are given at the end of the brochure.

Precision-Ground Steel Bars.—The English Steel Corporation Limited, of Sheffield, sends us an illustrated folder on precision-ground steel bars. Limits ranging from 0·00025 in. to 0·001 in. ± are worked to as specified, and many qualities of carbon and alloy steels are available. Centreless turned and cold-drawn bars are also supplied where such exacting limits are not required (the former to limits ± 0.004 in. and the latter with limits 0·002 in.), and, as in the case of precision-ground bars, in a large range of steels. Hexagon, in addition to round, section bars are available to 0·002 in. limits in sizes from 0·324 to 1·2 in. across flats. Tables of finishes and sizes of bars and particulars of the qualities of steels in which they are available are appended. An instructive series of illustrations shows the bars being machined and treated in the workshops.

"Tandem Review."—We have received from the Eyre Smelting Co. Ltd., of Tandem Works, Merton Abbey, S.W.19, the first number of vol. 2 of the *Tandem Review*, an occasional publication which describes products incorporating Tandem white metals and Ariel or Esco chill phosphor bronze in bearings and bushes. Since beginning the production of white anti-friction metals in 1902 this company has specialised upon bearing alloys, and today claims to have the largest and best-equipped white metal works in Europe, producing over 5,000 tons of white metal yearly. The purpose of the *Tandem Review* is to describe plant and machinery in which the products of the company are used. From time to time articles are given on the lining of bearings, the design of bearings, lubrication, and other items of technical interest. We have also received a copy of the Tandem technical white metal booklet, describing each of the company's alloys with the physical characteristics of the metal, a photomicrograph showing the crystalline structure, and an illustration of the ingot with the dimensions and weight. An indication of the type of service for which each is recommended is appended.

THE SCRAP HEAP

"The Railway Times"

Today marks the centenary of the oldest constituent paper of THE RAILWAY GAZETTE *to be established as a weekly. We therefore reproduce below a facsimile of the heading of the first number, and also reprint the text of the first editorial article as follows :—*

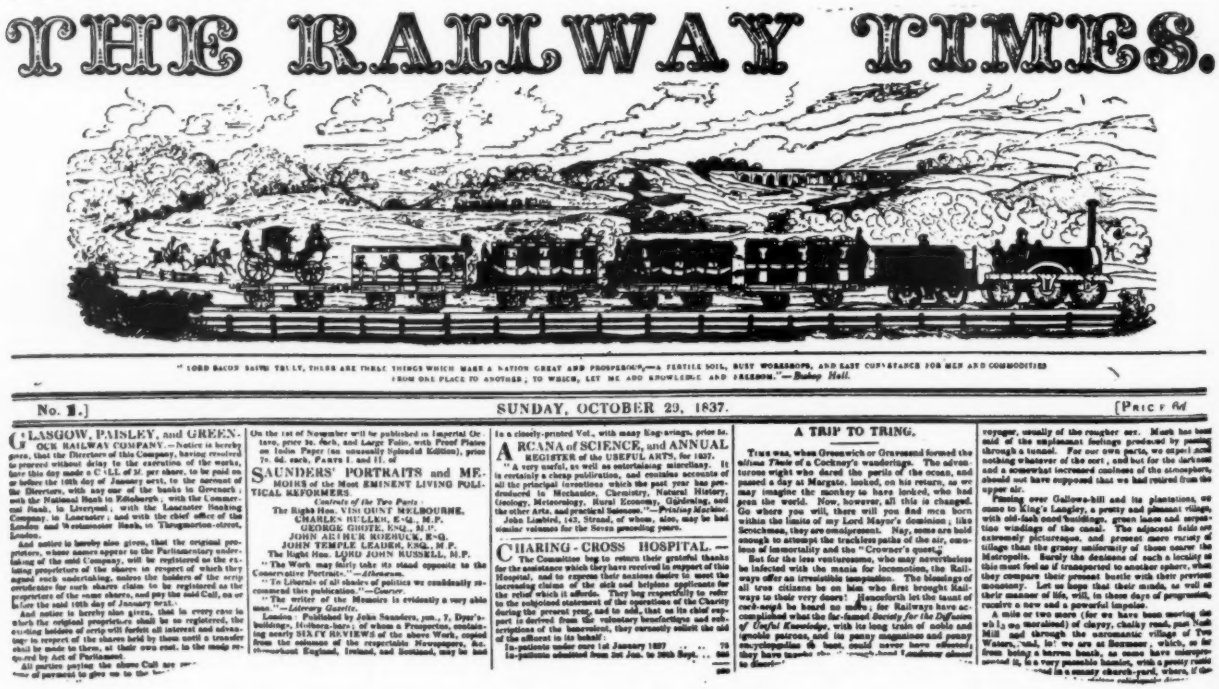
THE RAILWAY TIMES is so named for two reasons : first, because it is commenced in *Times*, of which the new system of RAILWAY communication is by far the most striking characteristic ; and second, because it will pay more attention than any other existing newspaper, to the growth and development of that system. The ordinary means of conveyance have been typified in the Newspaper press by *Posts* and *Couriers*, *Mercuries* and *Messengers* (even the mile-post has its *Standard*) ; and it is but right that a mode of transit which leaves all former modes behind it—which even laughs to scorn the fabled swiftness of the feather-footed *Herald* of the gods—should also have its literary representative. The application of steam to the purpose of inland communication is, manifestly, only in its infancy—yet what wonders has it not already achieved ! The triumphs of its career are not confined to the day-dreams of projectors, nor the reveries of enthusiasts ; every one can test, by the evidence of his own senses, the miracles it has wrought, and calculate, with all the certainty of the strictest demonstration, those greater miracles in reserve, which daily experience is rapidly evolving.

Notwithstanding the general acknowledgment of the importance of Railway communication, it is surprising how much ignorance prevails on the subject, even among those who might be supposed to be familiar with it in all its various details. That the public in general entertain notions so confused and vague, in reference to Railway matters, may easily be accounted for, from the circumstance that, hitherto, there has been no newspaper, on which they could rely, for full and satisfactory information, in regard to what is so intimately connected with their individual interests, and the general benefit of the community. To supply this desideratum is one of the reasons that have led to the establishing of the RAILWAY TIMES ; and this being the case, its projectors reckon with confidence on the steady patronage of the public.

Never was there, and perhaps there never will be, a crisis in the history of Railways, when the importance of such a publication as this, has been, or can be, more manifest. The extraordinary and unnatural excitement which prevailed on the subject of Railways some few months back, has passed away, and, as was to be expected, has been succeeded by an apathy and indifference which, if not equally extraordinary, are much more unnatural as well as infinitely more to be deplored. From the one extreme of reckless and indiscriminate confidence in whatever assumed the semblance of the popular project of the day, many have rushed into the opposite error of withholding, or withdrawing, every degree of credit from undertakings that are manifestly as conductive to private profit as they will be productive of public advantage.

That this state of things will long continue is not to be imagined for a moment. The real merits of Railways will not fail to be appreciated so soon as they are properly understood ; and to supply the public with the means of forming a right judgment, will be the unremitting aim of the conductors of the RAILWAY TIMES. Their resources are ample,—nay, in many respects unrivalled ; and in honesty of purpose, impartiality and independence, they will yield to none. While they are prepared, on the one hand, to expose the misrepresentations, and refuse the sophistries, of those, who, from interested motives, would seek to damp the ardour of Railway enterprise ; they will, on the other, be ever ready fearlessly to hold up to public reprobation every scheme based on deception and fraud, as well as to urge the correction of such abuses as detract from the utility of those splendid undertakings, the importance of which no one will venture to impugn.

But, while in accordance with its title, a prominence will thus be given, in the columns of this journal, to Railway matters ; due regard will, at the same time, be had to other subjects of general interest.—Politics, Science, Art, Literature and the Drama, will each receive its share of attention ; while the lover


THE RAILWAY TIMES.

"LORD BACON SAITH TRULY, THESE ARE THESE THINGS WHICH MAKE A NATION GREAT AND PROSPEROUS,—A FERTILE SOIL, BUSY WORKSHOPS, AND EASY CONVEYANCE FOR MEN AND COMMODITIES FROM ONE PLACE TO ANOTHER ; TO WHICH, LET ME ADD KNOWLEDGE AND FREEDOM."—*Bishop Hall.*

No. 1.] SUNDAY, OCTOBER 29, 1837. [PRICE 6d

GLASGOW, PAISLEY, and GREENOCK RAILWAY COMPANY.—Notice is hereby given, that the Directors of this Company, having resolved to proceed without delay to the execution of the works, have this day made a CALL of £ per share, to be paid on or before the 16th day of January next, to the account of the Directors, with any one of the banks in Greenock ; with the National Bank in Edinburgh ; with the Commercial Bank, in Liverpool ; with the Lancaster Banking Company, in Lancaster ; and with the chief office of the London and Westminster Bank, in Throgmorton-street, London.

And notice is hereby also given, that the original proprietors, whose names appear in the Parliamentary undertaking of the said Company, will be registered as the existing proprietors of the shares in respect of which they signed such undertaking, unless the holders of the scrip certificates for such shares claim to be registered as the proprietors of the same shares, and pay the said Call, on or before the said 16th day of January next.

And notice is hereby also given, that in every case in which the original proprietors shall be so registered, the existing holders of scrip will forfeit all interest and advantage in respect of the shares held by them until a transfer shall be made to them, at their own cost, in the mode required by Act of Parliament.

All parties paying the above Call are requested to give us to the 1st of November will be published in Imperial Octave, price 2s. 6d., and Large Folio, with Proof Plates on India Paper (an unusually splendid Edition), price 7s. 6d. each, PARTS I. and II. of

SAUNDERS' PORTRAITS and MEMOIRS of the Most EMINENT LIVING POLITICAL REFORMERS.

Contents of the Two Parts :

The Right Hon. VISCOUNT MELBOURNE.
CHARLES BULLER, ESQ., M.P.
GEORGE GROTE, ESQ., M.P.
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London : Published by John Saunders, jun., 7, Dyer's-buildings, Holborn-hars ; of whom a Prospectus, containing nearly SIXTY REVIEWS of the above Work, copied from the columns of the respectable Newspapers, &c., throughout England, Ireland, and Scotland, may be had in a closely-printed Vol., with many Engravings, price 5s.

ARCANA of SCIENCE, and ANNUAL REGISTER of the USEFUL ARTS, for 1837.

"A very useful, as well as entertaining miscellany. It is certainly a cheap publication, and contains accounts of all the principal inventions which the past year has produced in Mechanics, Chemistry, Natural History, Geology, Meteorology, Rural Economy, Gardening, and the other Arts, and practical Sciences."—*Printing Machine.*

John Limbird, 143, Strand, of whom, also, may be had similar volumes for the Seven preceding years.

CHARING-CROSS HOSPITAL.—The Committee beg to return their grateful thanks for the assistance which they have received in support of this Hospital, and to express their anxious desire to meet the increasing claims of the sick and helpless applicants for the relief which it affords. They beg respectfully to refer to the subjoined statement of the operations of the Charity during the present year, and to add, that on its chief support is derived from the voluntary benefactions and subscriptions of the benevolent, they earnestly solicit the aid of the affluent in its behalf :

In-patients under care 1st January 1837 75
In-patients admitted from 2nd Jan. to 28th Sept., ... 400

A TRIP TO TRING.

TIME was, when Greenwich or Gravesend formed the ultima Thule of a Cockney's wanderings. The adventurous wight who dared the perils of the ocean, and passed a day at Margate, looked, on his return, as we may imagine the monkey to have looked, who had seen the world. Now, however, all this is changed. Go where you will, there will you find men born within the limits of my Lord Mayor's dominion ; like Scotchmen, they are omnipresent. Nay, some are bold enough to attempt the trackless paths of the air, emulous of immortality and the "Crowner's quest."

But for the less venturesome, who may nevertheless be infected with the mania for locomotion, the Railways offer an irresistible temptation. The blessings of all true citizens be on him who first brought Railways to their very doors ! Henceforth let the taunt of cock-neigh be heard no more ; for Railways have accomplished what the far-famed *Society for the Diffusion of Useful Knowledge*, with its long train of noble and ignoble patrons, and its penny magazines and penny encyclopædias & tout, could never have effected, they have [illegible] and moreover almost

voyager, usually of the rougher sex. Much has been said of the unpleasant feelings produced by passing through a tunnel. For our own parts, we expect some nothing whatever of the sort ; and but for the darkness and a somewhat increased coolness of the atmosphere, should not have supposed that we had retired from the upper air.

Turning over Gallows-hill and its plantations, we came to King's Langley, a pretty and pleasant village, with old-fash ioned buildings, green lanes and serpentine windings of the canal. The adjacent fields are extremely picturesque, and present more variety of tillage than the grassy uniformity of those nearer the Metropolis. Surely the denizens of such a locality as this must feel as if transported to another sphere, when they compare their present bustle with their previous monotony. Let us hope that their minds, as well as their manner of life, will, in these days of progression, receive a new and a powerful impulse.

A mile or two more (for we have been moving the while, no mortalized) of clayey, chalky road, past Nash Mill and through the sacramentic village of Two Waters, and, lo ! we are at Berkmer, which, as far from being a barren heath, as some have misrepresented it, is a very possible location, with a pretty rustic [illegible] in a country church-yard, where, if the

Facsimile of the first heading of "The Railway Times," the earliest weekly railway journal. Its page was originally newspaper size, about 15 in. by 20 in.

A cartoon of the Railway Mania period

of *news* will find abundant means of gratification in the fullness and variety of the miscellaneous details. The large size of the sheet will enable the conductors to throw in a vast mass of information, which the limits of most other journals necessarily exclude. In short, by judicious selection and careful condensation, the RAILWAY TIMES will present a complete digest of domestic and foreign intelligence; a circumstance which cannot fail to recommend it to those, whose professional avocations preclude them from consulting the multitudinous publications of the day. The great majority of the London journals devote themselves almost exclusively to metropolitan news, with only casual and incidental notices of provincial proceedings. The RAILWAY TIMES, on the contrary, will regularly set apart a considerable portion of its columns to the record of everything of interest that transpires throughout the United Kingdom. Much attention will be devoted, also, to foreign news, so as to present a brief and lucid sketch of all that occurs during each week, stripped of that verbiage, and without those trifling details and endless repetitions, which render the foreign correspondence of our daily journals so tedious and repulsive.

As regards the politics of the RAILWAY TIMES, it is needless to say much in detail. A few Numbers will serve to develope these more fully than is compatible with the limits of this introduction. Suffice it, therefore, for the present, to say, that the politics of this paper are, in the widest and most emphatic acceptation of the term, *the politics of the People*. Firmly, and from conviction, attached to the institutions of the country, the conductors will cordially co-operate with those who labour to supply their deficiencies and remove their blemishes. They will prove themselves the uncompromising enemies of every abuse in State or Church; and the zealous, if humble, advocates of every scheme that aims at the advantage of mankind. In a word, to defend the rights, extend the privileges, and augment the comforts of *the many*, will be the constant endeavour of the RAILWAY TIMES, whether these important ends are to be attained by improvements in civil polity, or the diffusion of moral, political and general knowledge.

Sports and hobby week-end trains carrying in the baggage car canoes, "foldboats," bicycles, and other sporting paraphernalia, leave New York Friday and Saturday during the summer for the Berkshires. For those who like to ride—and 60 per cent. of the passengers do—40 or so Western horses have been provided; special license arrangements have been made whereby the angler may fish. Enthusiasts may have tennis, golf, and swimming, of course, or hike over the mountain trails. Bicycling, however, is the most popular sport—it enjoys a 90 per cent. patronage. There is dancing in the club car of Hobby Trains, and when you arrive you find awaiting you an evening of square dancing. The first "picture train," designed for candid camera fans and artists, was run recently to Stonington, Connecticut, a fishing village with a lighthouse. The train carried a dark room and dining car.—*From the New York "World-Telegram."*

* * *

A TALE OF TWO COUNTRIES

Few internal problems are of greater significance than the ever-growing transportation problem. No time should be wasted in attacking the difficult job of formulating a regulatory policy that will enable every form of transport to operate in the most efficient and economical manner—and enable all forms to compete on equitable terms.—*From the Parma (Idaho) U.S.A. Review.*

* * *

AN UNCONSIDERED POINT

On the basis of the frequency of highway level crossing accidents in relation to the number of trains operated in U.S.A., it is estimated by the Association of American Railroads that to limit the length of freight trains to 70 cars, as proposed in Congress, would result in 150 more persons being killed and 450 more persons injured at level crossings each year in that country.

* * *

AN UNDERSTUDY FOR EUSTON'S DOG COLLECTOR

Jack, the curly-haired, black retriever at Euston station, who has collected nearly £900 for the L.M.S.R. Benevolent Fund, is getting old, and it has been decided, as a precautionary measure, to appoint an understudy who can become familiar with his duties. The new dog, Roy, who has already been installed, is the second of the famous Euston collecting animals to bear this name, the first having collected £3,102, which is a record. Like Jack, Roy is a black retriever. Although new to the job he has already shown the friendly qualities, good manners, and willingness necessary for the successful carrying out of his philanthropic duties. Jack has been collecting at Euston since 1933, when he succeeded Victor, who collected £2,705. Jack, betraying no signs of his old age except, perhaps, that he is not quite so nimble on his feet, still manages to visit daily the principal departing trains, including the Royal Scot, Coronation Scot, and Mid-day Scot.

His appealing eyes have befriended him to royalty, politicians, film stars, and working people alike. And whether he receives a copper or a pound note, Jack always nods a cheery "thank you." His inseparable companion is Porter R. E. Edwards, who has been looking after the collecting dogs at Euston since 1920, seven, including Jack, having come under his care. Up to date, Porter Edwards and his dogs have collected £7,945, which has gone to relieve cases of sickness, want, and distress among the L.M.S.R. wages staff, and is administered through a benevolent fund. In addition the fund has benefited to the extent of over £2,000, collected by Porter Edwards's predecessor.

OVERSEAS RAILWAY AFFAIRS

(From our special correspondents)

IRISH FREE STATE

Prizegiving for the Improvement of Stations

On September 30, the Chairman, Sir Walter Nugent, Bart., presented the prizes for the improvement and beautifying of stations on the Great Southern Railways. After welcoming the prize winners, he stated that the board of directors was very pleased at the efforts made by the station staffs all over the system. He was glad to see a marked improvement in the majority of stations, and the public and the press also had noticed it, and had written complimenting the staff and the company. He thanked the stationmasters and staff who interested themselves in the scheme and congratulated not only those gaining prizes but also those who, without obtaining awards, yet accomplished a great deal in a short time. [Some of the excellent results may be seen depicted in the illustrations on page 738.—ED. *R.G.*]

The company was, he said, fortunate in securing the services of Mr. H. W. Stevens, a former Inspector of the Department of Agriculture and an expert horticulturist, who visited the stations and advised on questions of design, suitability of shrubs and plants, cultivation, &c.; one first prize winner had carried out all Mr. Stevens' suggestions.

In each of the seven areas into which the system is divided for purposes of this competition, one first, one second, one third, and two consolation prizes were awarded.

The seven first prizes went to the following stations:—

Area No.	Station	Stationmaster (or man in charge of halt)
1	Newbridge ...	... Mr. J. B. Coughlan
2	Carrick-on-Shannon	Mr. F. W. Livingstone
3	Shillelagh ...	... Mr. W. Black
4	Cahir ...	... Mr. T. Cousins
5	Rathcool halt	... Mr. J. Breen
6	Killonan halt	... Mr. M. Proctor
7	Mallaranny	... Mr. M. Forbes

Excursion Traffic

This traffic has been very satisfactory during the past season and the mystery trains, followed by half-day trips at specially reduced fares, have been extended and well patronised. All-in day trips, which include train journey with meals on the train and a road tour from the destination station, have been a great success and presented possibilities of further extension next season.

On September 18 the Chairman of Lamb Brothers, in celebrating the Golden Jubilee of his wedding and the 51st year of the firm's foundation, provided a special train for his staff, numbering 400. The party travelled from Dublin to Killarney and there made a tour of the lakes, subsequently returning home by special train. In Dublin it is unusual for one individual or firm to provide a special train, free of cost, to the employees and the example is welcomed.

INDIA

Non-official European Views on Wedgwood Report

The following additional points emerge from the discussion in the Central Assembly upon the Wedgwood Committee report. Mr. F. E. James, representing non-official European interests, moved an amendment for the adoption of the recommendations in the report regarding economic administration, statistics, improved railway facilities, and public relations. Also that the Wedgwood recommendations concerning staff discipline and training be adopted without delay. On the other hand, this amendment advocated the postponement of action upon measures to increase revenue, and rates and charges, pending results of the conference to be arranged between the railway authorities and representatives of commerce, industry, trade, and agriculture.

With regard to the recommendations in the report upon amalgamation of railways, the European group amendment advised their general adoption, subject to the modification that the contracts of company-worked lines should be dealt with as they expired. The amendment further recommended that the Wedgwood Committee's advice concerning the financial outlook of the Federal Railway Authority should be considered by the Assembly together with the resolution on cancellations of railway borrowings from the Depreciation Fund and arrears of contributions to the general revenues.

CANADA

New Type of Refrigerator Car

To provide a more efficient refrigeration for the carriage of perishable traffic, and insure that fresh foods reach their destinations in as perfect a state as possible, a new type of refrigerator car has been developed by the Canadian National Railways in co-operation with the Dominion Department of Agriculture at Ottawa. This new type of car has all its ice bunkers overhead, whereas in the ordinary type of refrigerator car the bunkers are at the ends. The car is iced through trap doors let into the roof; the ice capacity is 6,500 pounds. Tests show that the new car provides a more uniform temperature throughout the interior of the car, it being possible, according to tests, to maintain the same temperature at the top and bottom of the car. The temperature inside a car loaded with fish on arrival at Moncton was 10° above zero. Tests are continuing in order to obtain more complete data.

UNITED STATES

Dilatory Attitude of I.C.C.

The dilatory attitude of the Interstate Commerce Commission in dealing with the railways' request for readjustments in freight rates has added to prevalent pessimism. At the beginning of the year the commission forced the railways to remove the "emergency" surcharges on certain classes of goods (equivalent, roughly, to an average reduction of 5 per cent. in all freight rates). Immediately thereafter the railways applied for permission to change certain basic rates in order to recapture at least a part of the revenues lost when the surcharges were abolished. Prolonged hearings were held, and the commission took the case under advisement at the beginning of the summer, but as yet no decision has been forthcoming.

No Great Increase in Revenue Expected

From this decision, if favourable, the railways expect no more than some £10,000,000 in annual revenue, or only about half of the wage increase already granted to non-train employees. So it is deemed a certainty that, whatever the decision may be, the railways will have to apply at once for additional, and greater, increases, their exact size to be determined by whatever concessions are made to the train service employees.

Since the railways are everywhere beset by road competition, it is problematical to what extent any rate increases may actually be reflected in revenues, rather than in a shift of traffic from the rails to the roads. In any event, the snail-like pace of the I.C.C. in deliberating these questions makes it certain—failing an unlooked-for resurgence of traffic—that the railway future will remain clouded for many months, until new rates have finally been agreed upon and until their actual effect on railway receipts can be gauged.

Railways Agree to Train Crew Wages Increases

The Conference Committee of Railway Managers, which has been negotiating for some weeks with the leaders of the train and engine service unions on the latter's demand for an increase of 20 per cent. in wages, on October 3 capitulated to the extent of granting an increase of 1s. 10d. a "basic day" to these employees. Since most train and engine crews work upwards of 36 "basic days" a month, the award means an increase of upwards of £3 in monthly earnings and will average about 6½ per cent. above present wages. The cost

to the railways will be £7,000,000 annually, and as a result of this increase in addition to that of £19,800,000 already granted to other employees, railway net earnings will —unless saved by a substantial increase in rates—decline to about what they were in the worst year of the depression—1932.

Negotiations between the railways and the train service unions were conducted with the good offices of a member of the National Mediation Board, and the capitulation of the railways, despite the state of their finances, is understood to have been induced in no small measure by this member's favouritism for the unions' cause. American railway managers are, from bitter experience, fearful of Government officials and Government power, and had no taste for a battle with the unions with the New Deal Government as the unions' ally.

Increasing Unemployment

Meantime, the unions have secured their wage increases at a dear price in increased unemployment. Faced with increased per-hour wage costs, the railways have no alternative to heavy retrenchment, which has resulted in thousands of employees being discharged; and if important increases are to be granted the train service workers, additional thousands will perforce face the winter among the ranks of the unemployed.

The Southern Pacific "Sunbeams"

Providing welcome relief from the rather discouraging picture presented by traffic and earnings statements, are the continued evidences of technological progress in railway service. Among the most striking recent instances of this are the Southern Pacific's two new steam-drawn streamlined trains placed in operation in September between Dallas and Houston. The two streamlined 4-6-2 type locomotives for this service, resplendent in their orange, red and black liveries, were built in the company's workshops at Houston. They have 6 ft. 5 in. driving wheels and are cross counterbalanced to assure satisfactory operation at speeds up to 100 m.p.h. They develop a tractive force of 40,570 lb. and their total weight is 245 tons.

The two trains have eight cars each, built with Cor-ten steel frames and stainless steel sheathing, assembled by electric welding, and are said to weigh one-third less than cars of similar size of conventional materials and construction. A whole train, locomotive included, weighs 600 tons, is 673 ft. long and has 280 saleable seats.

MEXICO

Improved Passenger Traffic

The recent improvement in the influx of tourists into Mexico, mainly from the United States, has been reflected in railway passenger traffics. The figures recorded show that 7,849,675 passengers were carried on the National Railways during the first half year from January 1 to June 30, 1937, compared with a total of 6,788,739 passengers in the corresponding period of 1936.

NEW ZEALAND

Locomotive Instruction Car

A new scheme for the assistance and education of enginemen has been introduced by the Railway Department in the form of an instruction car, which is being sent to every depot where drivers are stationed. An old passenger carriage, rebuilt as a travelling schoolroom, is fully equipped with models of every part of a locomotive. They are set out on benches along the side of the car, each in cross-section, showing the internal working of each individual piece of machinery. Everything is neatly labelled and on the wall above are detailed plans showing the general arrangement and complete working of the parts.

Perhaps the most interesting of the models displayed is a complete working model of the improved triple Westinghouse brake. A turn of a lever and the whole apparatus is set in operation, the internal working being shown by the cross-section arrangement of the more important parts. All except this model were constructed at the Hutt railway workshops. The machinery is all up to date and of the type generally in use throughout the Dominion. Mr. B. Giblin accompanies the car as instructor, and is enthusiastic about the educational value of the scheme. It is of great assistance to engine-drivers to have the full workings of a locomotive explained so simply and clearly.

Pure Water on Trains

The whole of the water for drinking purposes on trains in New Zealand is filtered, and much care is taken in keeping the filtering system clean and in good condition. The Government Health Department recently and without notice, took samples of water from filters and lavatory taps in carriages on the Napier and New Plymouth trains, on the outward runs from Wellington. An official report received by the General Manager states that the samples were submitted to bacteriological tests, and the results showed that the water provided for the trains was entirely satisfactory.

CHINA

Railways and the War

Many South Manchuria Railway officials and members of the traffic corps of the Japanese army are now in Peiping and Tientsin ready to take over various North China lines from Chinese railway officials who have been carrying on despite difficult circumstances.

The following lines are affected by Sino-Japanese hostilities: Peiping-Suiyuan, Peiping-Hankow, Peiping-Tientsin, Peiping-Shanhaikuan, Tientsin-Pukow, Nanking-Shanghai, Shanghai-Hangchow-Ningpo, Kashing-Soochow, and Lung-Hai.

Shanghai-North station has been under fire from the outset, but was still in Chinese hands on September 2. Jessfield station, now called Shanghai-West, was bombed, and the girder bridge over the adjacent waterway was also bombed but escaped damage. Announcements have been broadcast of a skeleton train service from this station, which is on the western boundary of the foreign settlement. Shanghai-South station on the Shanghai-Hangchow-Ningpo Railway was heavily bombed on Saturday, August 28, and several casualties occurred among the Chinese railway headquarters employees who had been transferred over from Shanghai-North. The station was crowded with refugees who had been waiting several days in the heat of the summer for trains to take them to the interior, and a large number of them were killed.

Railways Bombed

Shanghai-North was bombed again on the night of August 31, and Markham Road junction was bombed twice on September 1. Trains from Jessfield going to Soochow *via* Markham Road junction reverse there to proceed via Chenju, and the Nanking-Shanghai line. Trains from Jessfield and Shanghai-South can proceed over the Shanghai-Hangchow-Ningpo Railway and *via* the Kashing-Soochow line also. A limited service is being maintained between Shanghai and Nanking.

Traffic on the Shanghai-Hangchow Railway, which was suspended recently as a temporary measure for a day, as a result of the bombing of a refugee train by Japanese planes at Sungkiang, has been resumed, as has the Shanghai-Nanking service, but it is now being conducted at night. The Hangchow-bound train leaves the Shanghai-West Station at 6.30 p.m., and the Nanking-bound train leaves at 7 p.m.

The latest railway to suffer damage from aerial bombing is the Lung-Hai line, several of the more important stations of which have been attacked. Not only has Lienyun, its terminal port, been bombed from the air, but it has also been shelled by a Japanese destroyer.

Canton-Kowloon Railway

The typhoon which struck Hongkong on September 2 caused extensive damage. The velocity of the wind is estimated to have reached the world record of 165 m.p.h., with the barometer at 29·298. The Canton-Kowloon Railway has been damaged by the floods which followed the storm, and it may take two or three weeks to effect repairs and restore traffic operations. The extent of the damage is estimated at $500,000.

THE FIREBOX PROPORTIONS OF MODERN LOCOMOTIVE BOILERS

A discussion of modern tendencies in boiler development, leading up to certain conclusions concerning combustion chambers and other recent devices

By E. C. POULTNEY

THE design of modern locomotive boilers has engaged much attention with the idea of improving performance. Boiler proportions assume added importance in view of the high sustained power necessary to meet modern conditions, but it is clear that enlarged capacity is becoming difficult to attain by a mere increase in dimensions. The most cursory glance at a modern locomotive is sufficient to demonstrate the strength of this statement.

Locomotive performance has been the subject of many experiments and investigations concerning the working of the boiler as a whole, and the action of its component parts have also received much attention. Tests on the road, and on locomotive testing plants, have furnished much valuable information; an example of the latter is the considerable work carried out by the Pennsylvania Railroad on the locomotive testing plant at Altoona, Pa. which is well known and appreciated as having furnished reliable and valuable data. These trials and others carried out in the United States have established the fact, among others, that of the heat liberated by the firebox a consistently high percentage is transferred across the heating surface; and further, that boilers differing fairly widely in design show this to range between values of about 90 to 80 per cent. Further, for a given boiler, the proportion of the heat made available by the firebox which is transferred across the heating surfaces, remains the same within narrow limits, regardless of the rate of firing (measured by coal fired per square foot of grate area per hour).

From the foregoing it is generally concluded that the falling off in the overall or evaporative efficiency with each increment in the firing rate is not due to failure on the part of the heating surfaces to absorb the heat offered, but rather to losses in the efficiency of the combustion process; or, in other words, boiler efficiency is governed almost entirely by the heat-producing capabilities of the furnace. It is not surprising therefore that firebox design continues to receive much attention, and that the firebox proportions adopted by different designers differ in many respects.

The object of the present article is to consider the firebox proportions of modern boilers—that is, in respect to size, as expressed by cubic capacity, or volume, and also by the heating surfaces provided in relation to the area of the fire grate; and also to discuss the probable effect of changes made in the proportioning of the related dimensions. Further, as the grate area is necessarily the basis upon which any discussion on boiler proportions must rest, the size and the proportioning of the grate must first receive consideration.

The size of grate required will depend primarily upon the power required, and the characteristics of the fuel to be used. Considerations of general design also govern to a varying extent the grate area finally adopted, firebox dimensions being ultimately determined by weight considerations, and by the desired wheel arrangement. Actually, the grate area is of prime importance, and in a general way it may be said that it can scarcely be made too large. The writer suggests that the correct method of evaluating the grate area required is to use the heating value of the coal expressed in B.Th.U. per lb. as a basis, and to assume a value for the power obtainable from each square foot of grate surface per hour. The power obtainable may be expected to increase with an increase in the value of the fuel fired, and in like manner it will become less when a fuel of lower calorific value is employed; from which it can be said that for an assumed power output, or for a given rate of firing, the area of the grate will be inversely proportional to the heat content of the fuel available. The method therefore of computing the grate area required would be as follows: in the first place the cylinder horsepower obtainable for each square foot of grate surface should be determined, and taking as a basis coal of good average quality, having a heat value of 14,000 B.Th.U., it is suggested that each square foot of grate surface will produce 40 i.h.p. under normal operating conditions.

Test results appear to show that approximately this power may be realised over a considerable range of working in the case of modern locomotives using superheated steam. Actually, the combination of speeds and the cut-offs used will depend upon the grate area in relation to the indicated tractive force, and to illustrate the effect of this, the writer has prepared a set of curves, Fig. 1, based on the following formula:—

$$\frac{\frac{375}{V} \times 40}{\frac{\text{In. T.F.}}{\text{G.A.}}}$$

From the above, the percentage of the maximum In. T.F. (indicated tractive force) can be obtained for any value of the In. T.F./G.A. (grate area) factor and given speed in miles per hour. Every curve represents a constant horsepower per square foot of grate area, and the set corresponds to five values for the In. T.F./G.A. factor, ranging from 600 to 1,000, and shows the proportion expressed as a percentage of the cylinder tractive effort available at speeds up to 80 m.p.h. Thus, if the grate area is such that the In. T.F./G.A. factor is 1,000, then at 60 m.p.h. the tractive effort available at the cylinders is 25 per cent. of the maximum; and further, if the grate is enlarged so as to make this factor 600, then as much as 40 per cent. of the cylinder tractive effort may be developed. This is interesting, for there is now a notable tendency towards an increase in the grate areas provided.

It may be remarked that the term indicated tractive force is used because the horsepower assumed per square foot of grate area is the cylinder or indicated power. Approximately, the rated tractive force which is measured at the rim of the driving wheels is 8 per cent. less than the cylinder tractive force, which being proportional to the mean effective pressure has a maximum value depending upon the cut-off in full gear.

Determination of Grate Area

The grate area required is determined in the following manner: Assuming that 40 i.h.p. may be developed for every square foot of grate when the fuel used has a heat

value of 14,000 B.Th.U., then with coal of, say, the lower heat value of 12,000 B.Th.U. and for the same power output, the grate area would be:—

$$\frac{40 \times 14{,}000}{40 \times 12{,}000} = 1{\cdot}167$$

Thus, 1·167 sq. ft. would be necessary to develop 40 i.h.p. In other words, practically 17 per cent. more grate area would be required for the same indicated horsepower. Similarly, if the fuel to be used has a higher heat content of, say, 15,000 B.Th.U., then a smaller grate would meet requirements, thus:—

$$\frac{40 \times 14{,}000}{40 \times 15{,}000} = 0{\cdot}933$$

Meaning that 40 i.h.p. would then be furnished by each 0·933 sq. ft. of grate area. If coal having a heat value of 15,000 B.Th.U. is used, then for 34 sq. ft. of grate the power obtained is $\frac{34}{0{\cdot}93} \times 40 = 1{,}460$ i.h.p., and to obtain the same power with 14,000 B.Th.U. fuel the grate area becomes:—

$$\frac{1{,}460}{40} = 36{\cdot}5 \text{ sq. ft.}$$

From the foregoing, the expression for determining the grate area for a given indicated power, and using as a basis 40 i.h.p. per sq. ft. of grate with 14,000 B.Th.U. coal, would be:—

$$\text{G.A.} = \frac{\text{h.p.} \times 14{,}000}{40 \times \text{F}}$$

Where G.A. is the required grate area, h.p. the required i.h.p., and F. is the heat value of the coal to be used.

Referring again to the curves in Fig. 1, it can be seen that the given i.h.p. at, say, some given speed in miles per hour will correspond to a certain indicated tractive force, which can be determined as follows:—

$$\text{In. T.F.} = \frac{\text{i.h.p.} \times 375}{\text{V}}$$

i.h.p. being the required power, and V the speed in miles per hour; further, the maximum cylinder tractive force being known, the relation between this and the grate area will enable, by means of the curves, the tractive effort available at all other speeds to be determined, remembering that the plotted curves correspond to 40 i.h.p. per sq. ft. of grate, and that as already shown, the values given to the curves would of course vary directly with the fuel used. In other words, a larger value for the In. T.F./G.A. factor may be used for a good quality coal having a high heat content, and a correspondingly lower value for a fuel of poorer quality.

Firebox Proportions

The value of the grate area having been considered, the proportions of the firebox in relation to the grate can receive attention. A study of recent practice shows fairly wide differences between the area of the firebox heating surfaces in relation to the grate surface; and, to show the variations existing, the leading dimensions and ratios typical of modern practice are given in Table I. In addition to particulars of the heating surfaces, the volume of the firebox has been given where this is available from previously published information, and in some instances this has been computed from the drawings. From the proportions shown it will be noted that the heating surface allowed for every sq. ft. of grate varies between the limits of approximately 6 to 3·7, and that where the information is available, the firebox volume in cu. ft. varies from about 4·5 to 6·7 cu. ft. for every sq. ft. of grate area.

A further point of interest may also be noted, which

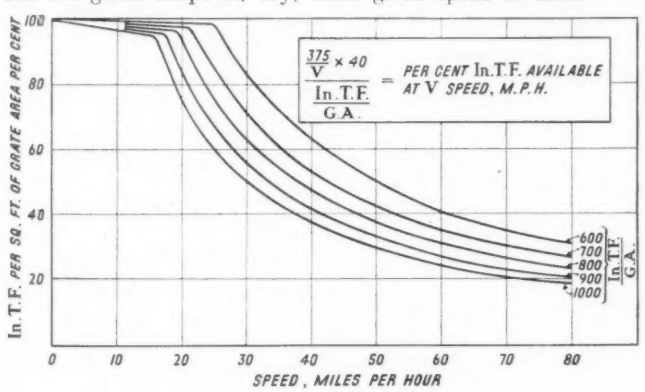


Fig. 1—Graphs showing indicated tractive force per sq. ft. of grate against speed

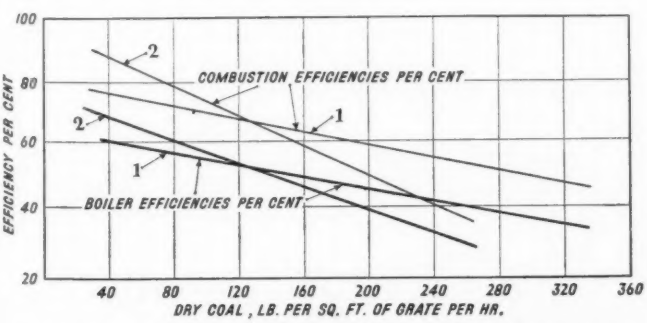


Fig. 2—Graphs showing boiler and combustion efficiencies against firing rate

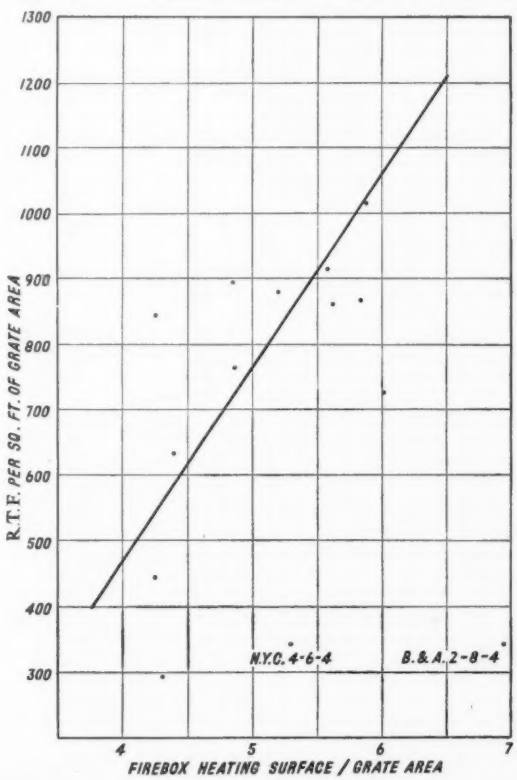


Fig. 3—Graph showing firebox heating surface/grate area ratio, against tractive effort/grate area ratio

TABLE I—LOCOMOTIVE BOILER FIREBOX PROPORTIONS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Railway	*L.M.S.R.*	*L.N.E.R.*	*L.N.E.R.*	*German State*	*Nord*	*I.R.S.*	*P.RR.*	*N.Y.C.*	*B. & A.*	*L.M.S.R.*	*L.M.S.R.*	*L.M.S.R.*	*S.R.*	*G.W.R.*	*I.S.R.*	*I.S.R.*	*S.A.R. & H.*	*S. Aust. Govt. Rys.*
Locomotive type..	4-6-2	4-6-2	4-6-2	4-6-2	4-6-2	4-6-2	4-6-2	4-6-4	2-8-4	4-6-0	4-6-0	4-6-0	4-6-0	4-6-0	4-6-0	2-8-0	4-8-2	2-8-4
Rated tractive force (R.T.F.) ..	40,300	36,465	35,455	41,700	32,000*	26,750	44,460	43,300	69,400†	33,150	26,610	25,455	33,500	40,300	22,600	34,300	47,980	43,400
Firebox type ..	Belp.	Round top	Round top	Belp.	Belp.	Round top	Belp.	Round top	Belp.	Belp.	Belp.	Belp.	Belp.	Belp.	Belp.	Belp.	Round top	Round top
Comb. chamber ..	Yes	Yes	Yes	No	No	Yes	Yes	No	No	—‡	—‡	No	—‡	No	No	No	No	Yes
Syphons	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes
Arch tubes ..	No	No	No	No	No	Yes	Yes	Yes	Yes	No	No	No	No	No	Yes	Yes	Yes	Yes
Heating surface, sq. ft., total (F.B.H.S.) ..	217	215	231·2	183	219	214	307	281	341	195	181	155	194	193·5	152·0	189·4	235·5	360
Volume, cu. ft. (F.B.V.) ..	261	252	274	248	226	255	427	372	465	210	203	166	—	—	—	—	—	—
Grate area, sq. ft. (G.A.)	45·0	41·25	41·25	48·2	37·6	45·0	69·8	81·5	100·0	31·25	31·0	27·8	33·0	34·0	32·0	32·0	62·5	59·5
Ratios :—																		
F.B.H.S./F.B.V.	0·83	0·853	0·843	0·738	0·97	0·84	0·719	0·757	0·733	0·928	0·892	0·932	—	—	—	—	—	—
F.B.H.S./G.A. ..	4·82	5·21	5·63	3·78	5·83	4·76	4·4	3·44	3·41	6·24	5·84	5·58	5·88	5·62	4·75	5·92	3·76	6·05
F.B.V./G.A. ..	5·8	6·1	6·64	5·12	6·0	5·66	6·12	4·56	4·65	6·72	6·54	5·98	—	—	—	—	—	—
R.T.F./G.A. ..	896	880	860	862	852	596	634	530	694	1,060	858	915	1,015	1,185	706	1,063	768	728.

* Compound ; De Glenn system. † 60 per cent. limited cut-off. ‡ Modified combustion chamber.

TABLE II—LOCOMOTIVE BOILER FIREBOX PPORTIONS

	1	2	3	4	5	6	7
Railway	*P.RR.*	*P.RR.*	*S.A.R. & H.*	*S.A.R. & H.*	*B.-N.R.*	*S.A.R. & H.*	*L.N.E.R.*
Locomotive type ..	4-8-2	2-10-0	Garratt	Mallet	Garratt	Garratt	Garratt
Rated tractive force (R.T.F.)	64,550	90,024‡	53,700	48,370	69,660	78,650†	72,930
Firebox type ..	Belp.	Belp.	Belp.	Round top	Belp.	Round top	Round top
Comb. chamber	Yes	Yes	No	Yes	No	No	No
Syphons ..	No	No	No	No	No	Yes	No
Arch tubes ..	Yes	Yes	No	Yes	Yes	Yes	—
Heating surface, total sq. ft. (F.B.H.S.) ..	399	287	211·3	250	286	340	224
Volume, cu. ft. (F.B.V.)	582	364	311	327	—	—	—
Grate area, sq. ft. (G.A.)	69·9	69·9	51·83	55·17	70	74·5	56·5
Ratios :—							
F.B.H.S./F.B.V.	0·684	0·787	0·677	0·763	—	—	—
F.B.H.S./G.A. ..	5·71	4·11	4·07	4·52	4·09	4·55	3·96
F.B.V./G.A. ..	8·33	5·21	6·0	5·92	—	—	—
R.T.F./G.A. ..	923	1,286	1,034	874	995	1,054	1,280
F.B.H.S./F.B.V.*	0·635	0·709	—	—	—	—	—

* Based on F.B.H.S. less heating surface of arch tubes.
† At 0·75 boiler pressure. ‡ 50 per cent. limited cut-off.

TABLE III—LOCOMOTIVE BOILER FIREBOX PROPORTIONS

	1	2	3	4	5	6	7
Railway	*N. & W.*	*U.P.*	*A.T.S.F.*	*N.P.*	*D.R.G.W.*	*C.B. & Q.*	*C.M.St.P.*
Locomotive type ..	2-6-6-4	4-6-6-4	2-10-4	2-8-8-4	2-8-8-2	2-10-4	4-4-2
Rated tractive force, lb. (R.T.F.) ..	104,500	97,400	93,000‡	139,900†	131,800	90,000§	307,000‖
Firebox type ..	Round top	Round top	Round top	Round top	Round top	Round top	Round top
Comb. chamber	Yes	Yes	Yes	Yes	Yes	Yes	No
Syphons ..	No	No	Yes	Yes	Yes	No	Yes
Arch tubes ..	Yes	Yes	Yes	No	Yes	Yes	No
Heating surface, total sq. ft. (F.B.H.S.) ..	587	625	592	872	715	448	294
Grate area, sq. ft. (G.A.)	122	108·2	121·5	182	136·5	106·5	69
Ratios :—							
F.B.H.S./G.A.	4·80	5·76	4·87	4·77	5·22	4·21	4·26
F.B.H.S./G.A.*	4·33	5·07	3·64	3·35	4·09	2·83	3·68
R.T.F./G.A. ..	856	897	765	765	964	845	445

* Based F.B.H.S. less heating surface of arch tubes and/or syphons.
† At 70 per cent. cut-off.
‡ At 0·70 per cent. boiler pressure, 60 per cent. cut-off.
§ Limited cut-off, 61 per cent.
‖ Oil fuel.

is the relation between the grate area and the rated tractive force, for while this ratio is complicated by the fact that it is governed by the class of fuel used, and the proportion of the maximum tractive force which is required at average running speeds, there is nevertheless a general tendency for the value of this factor to rise when the size of the firebox as shown by the heating surface increases in relation to the grate area. This is only another way of stating that when the grate is relatively small there is a general tendency on the part of the designers to increase the size and volume of the firebox per square foot of grate area. An increase in the ratio between the firebox heating surface and the grate means that the heat receiving surfaces are increased relatively to the heat radiating surface, and that the volume of the combustion space is also increased.

For satisfactory combustion conditions there are two prime essentials, high firebox temperatures, and adequate air supplies. These should be supplemented by means for a proper intermixing of the products of combustion. The maintenance of high firebox temperature depends on the efficiency of the combustion process, and also upon the rate at which the heat is taken up by the water contact surfaces (*i.e.* the heating surface), and for a given grate area the larger the firebox heating surfaces the more rapidly will the heat be dissipated by transfer to the surrounding water. An increase in the heating surface means a larger firebox evaporation and a lower evaporation per square foot of its heating surface, and therefore at the same time a reduction in the temperature of the flue gases.

On the other hand, if the larger firebox heating surface means at the same time an increase in the volume/grate area ratio, then if the volume is effective in improving combustion, that is, by increasing the amount of coal burned in relation to the amount fired, then the capacity of the boiler may be increased; because, though gas temperatures may be lower, the quantity of gas liberated by the firebox will be greater. How far an increase in volume is effective in materially improving the combustion of the coal fired appears to be a question which still requires an answer. The writer is rather of the opinion that the most important consideration so far as steaming power and efficiency are concerned is the size of the grate, and if this is or can be proportioned so as to keep the rate of firing at a low figure, or, put in another way, to maintain a low value for the In. T.F./G.A. factor, firebox dimensions are of less importance.

Referring again to the question of heat absorption by the firebox, and its effect on the resulting temperatures, an examination of the data presented relative to firebox proportions, and in particular to the surface/volume ratios, will indicate that design plays an important part. This ratio is seen to vary from about 0·93 sq. ft. of heating surface per cubic foot of volume, to a minimum figure of 0·7.

Firebox Surfaces and Volumes

The firebox dimensions and proportions of a number of modern boilers are given, as already mentioned, in Table I, and also by Tables II and III; and a reference to examples 11 and 12 which are alike in general design, is interesting as showing the influence of shape on the heating surface/volume ratio. Both these fireboxes are of the Belpaire pattern, example 11 being of the type having the tube plate pushed forward into the barrel, so that the lower part of the tube sheet and the throat sheet are inclined forward at a fairly steep angle, a construction which has the effect of shortening the barrel section, and of adding to the volume of the firebox between the tube sheet and the arch. The other firebox is very similar in general design, but has a vertical tube sheet of the usual pattern.

It will be noted that the former design gives a smaller surface/volume ratio, and that the volume provided for each square foot of grate is larger, both desirable features for good combustion conditions. The one difficulty attending the use of this modified form of construction is that the distance between the tube plates tends to become rather short; but to meet this the diameter of the tubes may be reduced, and compared with earlier boilers for locomotives of the class for which this boiler is used, this has actually been done. In a similar manner a further comparison can be made by referring to Table II, where columns 3 and 4 compare two fireboxes, one of the Belpaire pattern of a general design and shape used for Garratt locomotives, with a round-top firebox having a fairly large combustion chamber. Here the Garratt type box shows a lower heating surface/volume ratio, possibly due in a measure to the Belpaire form of construction.

In the same table, examples 1 and 2 compare two Belpaire fireboxes of almost identical design, except that example 1 has a very long combustion chamber compared with example 2, which, though also fitted with a combustion chamber has one very much shorter. The ratios given relative to these two fireboxes enable a similar comparison to be made to that between those previously mentioned, and it will be seen that the firebox with the larger volume shows better surface/volume and volume/grate-area ratios. The performance of these two fireboxes on test will now be considered, and as they are equal in respect of grate area, and are practically identical in design, except for the addition in one case of a very extensive combustion chamber extending 96 in. into the barrel section of the boiler, the results are interesting.

Firebox Volume and Combustion Efficiency

The effect that volume may have on the efficiency of the combustion process is a matter of great importance, because the rather rapid fall in boiler efficiency as the rate of firing increases is due almost entirely to the losses in unburned coal as the rate at which it is fired becomes greater. In order to furnish some idea as to the effect of volume on the efficiency of combustion, a graph, Fig. 2, has been prepared based on tests made at Altoona, Pa., on the locomotive testing plant of the Pennsylvania Railroad. The fireboxes compared are those of which particulars are given in Table II, columns 1 and 2. The thick lines in the graph correspond to the boiler efficiencies, and the thin lines show the efficiency of combustion, both being plotted against the firing rate in pounds of dry coal per square foot of grate area per hour. The lines marked 1 refer to the firebox having the larger volume, and a heating surface/grate factor of 5·71; while the lines numbered 2 are for the firebox with the smaller heating surface/grate ratio of 4·1. The following are the firebox temperatures recorded, and the firing rates:—

Firing Rate Dry Coal lb. per sq. ft. of grate per hr.	Temperatures (Fahrenheit) No. 1 Deg. F.	No. 2 Deg. F.
68·4	—	2,560
67·3	2,278	—
127·1	—	2,648
128·1	2,681	—
212·1	—	2,892
231·2	2,577	—

The temperatures are those found near the fuel bed, and have been chosen at as near equal rates of firing as possible. It will be noted that the firebox having the smaller heating surface, in relation to grate area, No. 2, shows the higher temperatures; and that up to a firing rate of about 120 lb. of coal per sq. ft. of grate per hr., both

† At 0·75 boiler pressure.
‡ 50 per cent. limited cut-off.
|| Oil fuel.

the combustion and overall efficiencies were higher than with the boiler having the larger firebox, but that above that rate of firing the larger firebox with the greater volume showed to a marked advantage. It could be forced to a firing rate of about 320 lb. of coal per hr. per sq. ft. of grate, when the boiler efficiency was as good as for firebox No. 1 at a firing rate of about 220 lb. per hr.

From the results outlined it would seem that, at very high rates of firing, added volume is a considerable advantage Further, as the firebox heating surface/grate-area factor may be taken as a measure of the volume in relation to the grate area, the remarks previously made concerning the tractive force/grate-area ratio and the firebox heating surfaces in proportion to the grate area are of added interest. In reference to the test results mentioned it is important to note that the coal used in each case was exactly the same in heat value and other principal characteristics.

General Remarks on Firebox Design

The relation between the area of the grate and the rated tractive effort, and also between the firebox heating surfaces and the grate area, has already been mentioned, and to investigate these ratios further Fig. 3 has been prepared, in which the rated tractive effort per sq. ft. of grate area is shown plotted against the firebox heating surface allowed per sq. ft. of grate. It is admitted that the various points in the graph are rather widely scattered, but a line drawn through them nevertheless indicates that, as a rule, designers increase the firebox dimensions when the grate area is small relative to the tractive effort; in other words, when the power required per unit of grate is large, that is, when firing rates may be expected to be relatively high, designers as a rule prefer a larger firebox.

The firebox particulars shown in Table II have already been mentioned in respect of the first four examples. The remaining three relate to articulated engines of the Garratt type. The firebox design used for locomotives of this particular system of articulation is of uniform pattern, that is, the grate is always wide and the length moderate; moreover, the side sheets are straight and slightly inclined from the vertical, the crown sheet being of smaller area than the size inside at the foundation ring. The tube sheet is vertical. This form seems to provide an efficient design from the point of view of the surface/grate ratio, and at the same time gives a good volume per sq. ft. of grate. The examples given show heating surface/grate-area ratios of from 3·96 to 4·55, and, from an examination the writer has made of a large number of Garratt designs, it is found that the heating surface per sq. ft. of grate lies between these limits in every case, and is usually about 4·0 or a little more. It may be noted that in the case where it is shown to be 4·55 the box in question is equipped with syphons and arch tubes (two of each).

Particulars of very large fireboxes used for locomotives articulated on the Mallet system are given in Table III, and it will be observed that the heating surfaces are very extensive, but that, although this is so, the surface/grate ratios are by no means high, especially when this ratio is calculated by taking the surface of the box and combustion chamber only. The Norfolk and Western (N. & W.), and Union Pacific (U.P.), are two recent designs, and both have large combustion chambers, but the heating surface in proportion to the grate is not large. The same can be said of the Northern Pacific (N.P.), even though this firebox has five syphons, three in the box proper supporting the arch, and a further two in the combustion chamber. It will be noted that the tractive force per square foot of grate is low, due in this instance to the poor quality of fuel used, which has a heat value as received from the mines of about 7,000 B.Th.U., and when dried, of about 10,000 B.Th.U.

The last example in the table is the new Chicago Milwaukee St. Paul and Pacific high-speed Atlantic engine. The firebox is not fitted with a combustion chamber, but the tube sheet is pushed forward, and the throat sheet sloped forward to correspond, and there is one syphon. It will be seen that the surface/grate factor is small, and that the grate area* is very large in relation to the rated tractive force, thus indicating ample steaming capacity.

Concluding Remarks

The conclusions drawn from these brief notes on the proportions of the fireboxes of locomotive boilers may now be summarised. The volume of the combustion space assumes greatest importance when the rate of firing is high, while at low rates it would seem that a relatively small volume and a small heating surface/grate-area factor give the best results. The temperatures tend to be higher in the smaller firebox at the lower rates of combustion, and, from experimental data at the writer's disposal, the temperature gradient at low rates of firing is steep, and in consequence the gas temperatures at the tube sheet are very low. As the rate of firing advances, the fall in temperature diminishes, so that at very high rates of firing the temperature difference between the fuel bed and the tube sheet is much less. These temperature differences may be about 800° F.; at low rates of firing, and at the middle rates some 600°; and reduced to 400° at the very highest rates. These figures correspond to those observed where the combustion chamber is 8 ft. long, and the total distance from the tube sheet to the grate therefore considerable.

From these remarks, and those made relative to the efficiency of combustion, it is suggested that combustion chambers should be used with caution. The temperature drop at medium firing rates is considerable, meaning a large heat transfer by the firebox, and care should be taken that the gas temperatures are not too low at average firing rates, for this would mean low tube and flue gas temperatures, possibly affecting adversely the superheat given to the steam.

Consideration of the foregoing leads to the question of syphons, which are now becoming much used. It will be evident that syphons add largely to the firebox surfaces, further, as they are always directly in the gas stream, they abstract heat not only through radiation, but also by gas contact, both assisted by the circulation of the water through the syphon. It would appear that syphons must increase firebox evaporation considerably, and that this being so, ample grate area in proportion to the total firebox heating surface should be provided. The particulars given in Table III support this view. Combustion chambers also require a large grate if flue temperatures are to be maintained fairly high, unless, of course, the rate of firing is considerable.

In general, the writer is inclined to the view that combustion chambers, where necessary as a means of keeping tubes and flues within reasonable lengths, should be kept as short as possible. Any heat rejected by the firebox is always readily taken up by the tubular heating surfaces. Combustion volume will assist the proper burning of the fuel at high rates of firing, but, as this condition must mean a heavy demand on the blast and increased cylinder back pressures, it seems logical to suggest that added grate area is to be preferred as a means of increasing power output through the greater amount of coal fired and burned, at the lower rates of firing per square foot of grate per hour.

* Oil Fuel. Cross-Sectional Area at Foundation Ring.

SIGNALLING CONCENTRATION AT JOHNSTON STATION, GREAT WESTERN RAILWAY

Long-distance point operation by double wires

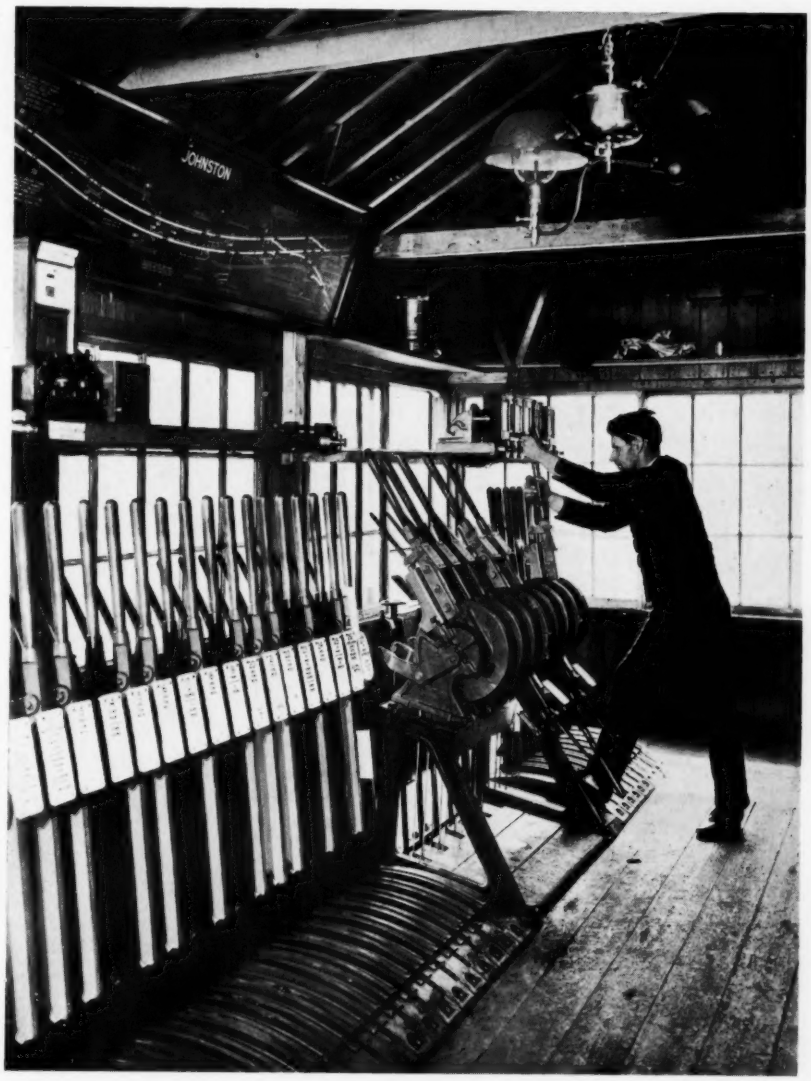
JOHNSTON STATION, the junction for Neyland on the Great Western line from Carmarthen to Milford Haven, provides an interesting and up-to-date example of signalling concentration. Previously two signal boxes about 700 yd. apart, known as Johnston East and West, respectively controlled the station and the actual junction where the double line becomes two single lines to Milford Haven and Neyland. The down facing points and junction diamond in the up main line were replaced by a direct junction with a facing crossover ahead of it, (see diagram), permitting the dispatch of a down train to Neyland while an up train from Milford Haven on the main line overtakes another Milford Haven train that has been held on the up branch. The latter is continued parallel to the up main from the junction to the station. The West signal box, which stood in the fork of the junction, was abolished and the East box extended 6 ft. at its east end to accommodate a new locking frame and the key token instruments for the single lines, formerly placed in the West box.

Track Circuits and Electric Locking

Track circuits are provided from the up main and branch home signals right through the station, to join up with those previously existing at the up end, affording continuous protection on the main lines throughout interlocking limits. The condition of the various sections is shown on an illuminated diagram of the normally-dark type. All signals are front locked by the track circuits over which they read and the advanced starters Nos. 5 and 6 are released by the respective key token instruments. Auxiliary instruments are provided at those signals, with telephone communication to the signal box, enabling a train to proceed up to them to await "line clear." The withdrawal of a token from these instruments, of course, also releases the relevant signal. Each track circuit is fed from two caustic soda 1,000 amp-hr. cells.

Locking Frame and Double-Wire Equipment

The new locking frame has 40 working and 4 spare levers and is of composite construction, there being 28 working and 4 spare levers of the Westinghouse Brake & Signal Company's standard type with catch-handle locking, and 8 double-wire levers, with broken-wire locking device, all arranged in the correct sequence. The locking is below the floor; the connections to it from the double-wire levers can be seen in the photograph. The points formerly worked from this box, when it was known as Johnston East, are worked by rodding but those previously operated from the West box at the junction are now worked by double-wire transmissions, the distance varying from 340 to 730 yd.; this system has been successfully used by the Great Western Railway at several places in the South Wales area for isolated cases of point operation at similar distances and was therefore selected for this installation. Compensations arranged in groups of three or two to suit local conditions, are provided in the transmissions, which are on the down side of the line, except those for levers Nos. 34 and 35.



Interior of signal box, showing the composite locking frame with set of 8 double-wire levers between Nos. 27 and 36, and connections to the interlocking below the floor

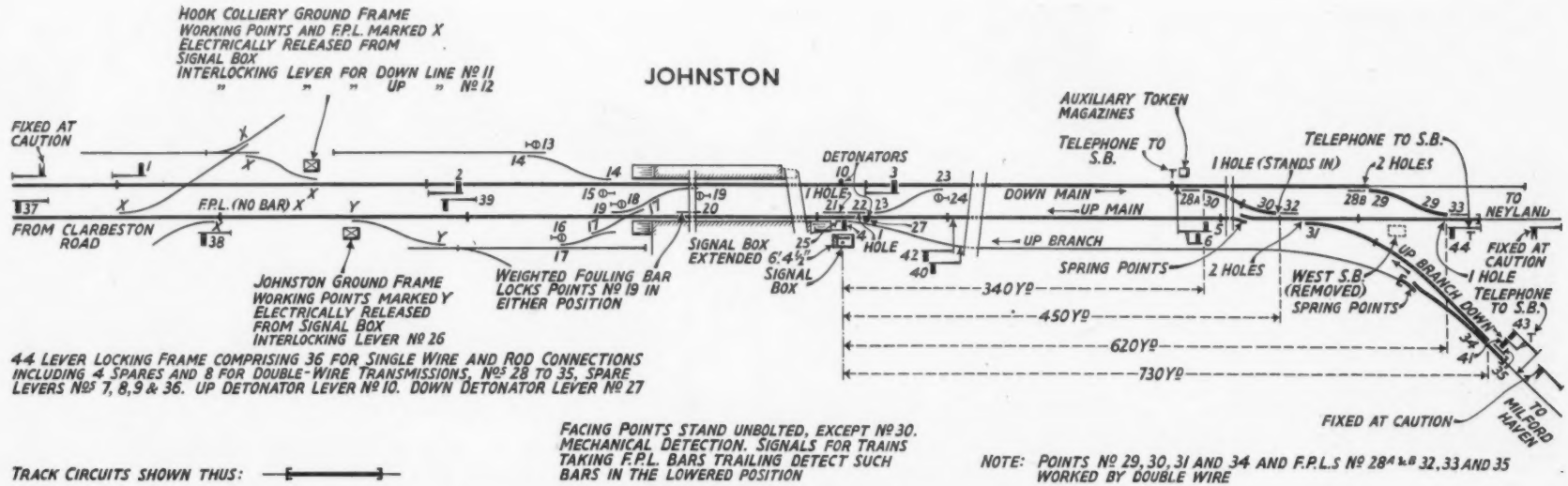
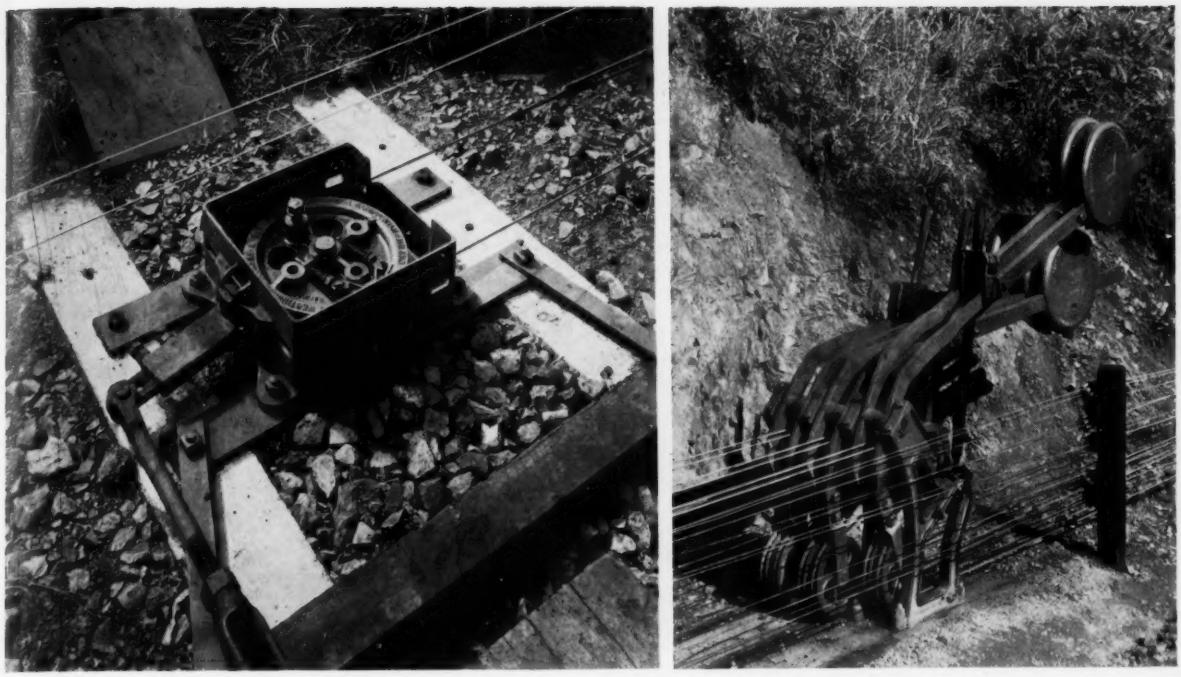

JOHNSTON
HOOK COLLIERY GROUND FRAME
WORKING POINTS AND F.P.L. MARKED X
ELECTRICALLY RELEASED FROM
SIGNAL BOX
INTERLOCKING LEVER FOR DOWN LINE Nº 11
" " " UP " Nº 12
FIXED AT CAUTION
FROM CLARBESTON ROAD
F.P.L. (NO BAR)
JOHNSTON GROUND FRAME
WORKING POINTS MARKED Y
ELECTRICALLY RELEASED
FROM SIGNAL BOX
INTERLOCKING LEVER Nº 26
WEIGHTED FOULING BAR
LOCKS POINTS Nº 19 IN
EITHER POSITION
SIGNAL BOX EXTENDED 6'4½"
SIGNAL BOX
DETONATORS
1 HOLE
HOLE
AUXILIARY TOKEN MAGAZINES
TELEPHONE TO S.B.
1 HOLE (STANDS IN)
2 HOLES
DOWN MAIN
UP MAIN
UP BRANCH
SPRING POINTS
2 HOLES
WEST S.B. (REMOVED)
SPRING POINTS
UP BRANCH DOWN
TELEPHONE TO S.B.
FIXED AT CAUTION
1 HOLE
TELEPHONE TO S.B.
TO NEYLAND
TO MILFORD HAVEN
FIXED AT CAUTION
340Yds
450Yds
620Yds
730Yds
44 LEVER LOCKING FRAME COMPRISING 36 FOR SINGLE WIRE AND ROD CONNECTIONS INCLUDING 4 SPARES AND 8 FOR DOUBLE-WIRE TRANSMISSIONS, Nos 28 TO 35, SPARE LEVERS Nos 7, 8, 9 & 36. UP DETONATOR LEVER Nº 10. DOWN DETONATOR LEVER Nº 27
FACING POINTS STAND UNBOLTED, EXCEPT Nº 30. MECHANICAL DETECTION. SIGNALS FOR TRAINS TAKING F.P.L. BARS TRAILING DETECT SUCH BARS IN THE LOWERED POSITION
NOTE: POINTS Nº 29, 30, 31 AND 34 AND F.P.L.S Nº 28A & B 32, 33 AND 35 WORKED BY DOUBLE WIRE
TRACK CIRCUITS SHOWN THUS:

Diagram of new signalling layout at Johnston, Great Western Railway

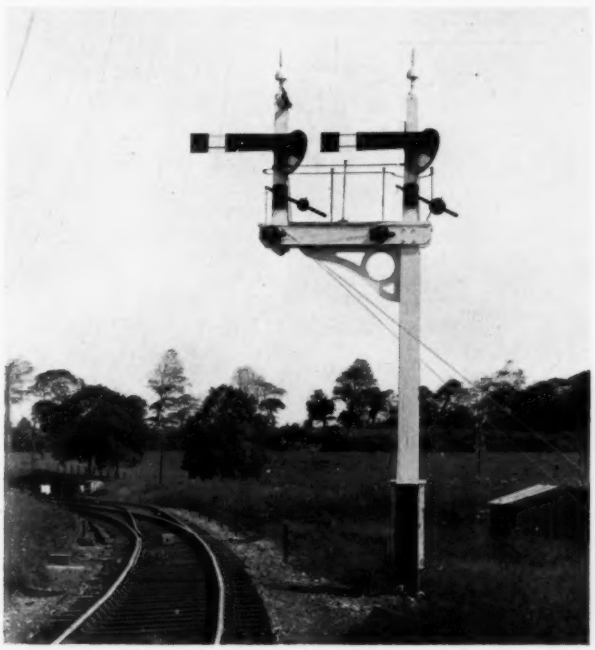
***Left:** Lockbar mechanism operated by double-wire lever No. 35, with points No. 34 in background. **Right:** View of the junction looking along the single line to Neyland, with Milford Haven line on the right, showing points Nos. 30, bend, 31 and F.P.L. locking both, No. 32, all worked by double wires. The old West box stood between the signal and the telegraph pole*



Left: Double-wire mechanism for operating points No. 34, showing broken wire locking attachments and adjustable crank arm. Right: Set of compensators for 3 double-wire transmissions

The point mechanisms are of the latest type with cam drive and over-run in each direction and adjustable crank arms, and have broken-wire locks, as have the bar mechanisms also. Flexible cable is used on the lever and mechanism drums and at deviating wheels, with suitable joints for connecting it to the solid operating wires. The facing point locks are of the G.W.R. standard pattern, whether double-wire or rod operated. The detection is entirely mechanical, an unusual feature being that such lockbars as are run over when the points they protect are approached in the trailing direction are detected to ensure their being fully down. Thus signal No. 5 detects lockbar No. 33 down and signal No. 6, lockbar No. 35. All vertical and flat wheels in compensators and point or bar mechanisms have roller bearings. The existing rod and wire connections on the east side of the signal box were coupled up to the new frame, but on the west side new connections were provided. The up main and branch inner home, and bracket up branch home, signals were renewed. The down main home for the old West box was moved back about 20 yd. to become the down advanced starter in the new scheme. All signals are operated by the ordinary single-wire method, save the distant signals, which are fixed in the " caution " position.

The installation was carried out by the Westinghouse Brake and Signal Co. Ltd. under the direction of the Great Western Railway Company's Signal Engineer, Mr. F. H. D. Page.



New bracket post with up branch home signals Nos. 41 and 43, and points Nos. 35 and F.P.L. No. 34 in background

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EXTENSION OF TRAIN CONTROL SYSTEM IN EAST ANGLIA.—The L.N.E.R. has decided to extend the existing arrangements for train control in East Anglia, the area roughly embracing that served by the old G.E.R. Trunk telephone circuits are to be provided between the head office control at Liverpool Street, the present district control offices at Stratford and Cambridge, the train working office at Ipswich, and the District Superintendent's Office at Norwich. In addition, the control system is to be extended to Southend and a new telephone circuit installed embracing the section of line from Stratford to Harwich, Clacton, and Walton-on-Naze. These revised control arrangements will enable the operating staff to keep in touch more closely with hour-to-hour requirements and to regulate the flow of traffic and train working over this busy area in accordance with the requirements of traders and the public.

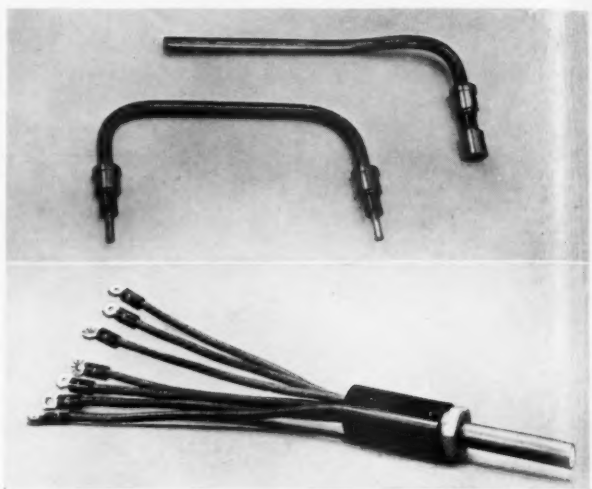
PYROTENAX CABLES

Mineral insulation and metallic sheathing are the chief features responsible for the remarkable characteristics of this new cable

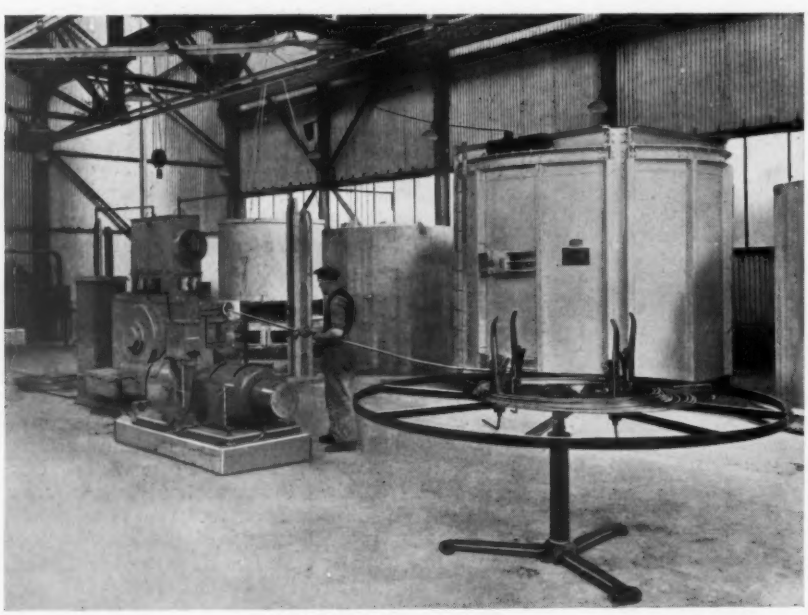
AS was indicated in last week's issue, the manufacture has been begun on the North-East Coast of a novel type of electric cable, possessing qualities of direct railway interest. The new cable is remarkably robust, fireproof, and suitable for either alternating or direct current at voltages not exceeding 600. As it essentially incorporates a metal sheath it is applicable to concentric wiring, using the sheath as a return; this system is permitted in buildings by the Institution of Electrical Engineers' Regulations, provided that the system is fed through a transformer and metallically separated from public mains, or that the system is self-contained. It would appear particularly suitable for the wiring of rolling stock, and the robust character of the cable has an obvious appeal for kitchen use or wherever rough treatment is probable.

The sheath of the cable is usually of copper, and even if a concentric system is not used it provides an excellent means of securing earthed continuity. Compressed dehydrated magnesia is used for the insulation and this is so compact that it virtually reinforces the copper sheath from within, making the cable difficult to deform even by repeated blows. The cable, in fact, behaves similarly to a solid bar but it can be bent through acute angles without any risk of the conductors becoming decentralised. This is a useful feature for surface wiring and the stiffness of the cable also permits the use of supports at relatively wide spacings.

High thermal conductivity is another characteristic of the insulation. By reason of this quality it is possible to increase the current rating of the conductors beyond the limits approved for vulcanised indiarubber or paper insulation, the sheath acting as an excellent radiating surface to dissipate heat, but, of course, in such cases the voltage drop is similarly increased and generally proves the limiting factor. Magnesia is neither inflammable nor supports combustion and thus the new cable is truly fireproof; its electrical operation is not affected by temperatures approaching the melting point of copper. Moreover, although magnesia is hygroscopic, its use in a compressed form prevents serious effects if the cable ends are left unsealed for several days during erection. Proper sealing fittings are provided for joints and connections to junction boxes, and frequently it is found possible to eliminate the former by arranging all connections of lengths to be made at boxes which are required for other purposes.



Typical sealing ends of Pyrotenax cables



A corner of the new factory, showing the last drawing machine and annealing equipment

The manufacturing process begins with the pressing of magnesia into blocks or bobbins, complete with holes for the conductor cores. These bobbins are then raised in temperature in a rotating hearth electric furnace until all the free and combined moisture is driven off. The bobbins are then introduced into a copper tube which has previously been straightened and cleaned internally, special arrangements being made so that the conductor holes register. Dry inert gas is blown through the tube to prevent the magnesia taking up moisture from the air. When the tube is full of bobbins the conductor cores are inserted and one end is swaged down to give a grip; the tube is then drawn down in several stages to its final size, with interstage and final annealing as required. This procedure subjects the magnesia to a compression pressure of the order of 25 tons per sq. in., leaving it compacted and homogeneous to a remarkable degree. Insulation tests

frequently show 7,000 megohms a mile. The finished cables are supplied in coils wrapped in hessian, not wound on drums. Lengths can be joined by sleeves on site at the factory. Simple tools are available for stripping off the sheath at the ends of lengths, and special fittings can be supplied for sealing where excessive dust and moisture necessitate additional precautions against surface leakage. It is claimed that erection is easier than with ordinary screwed conduit, and the cable can be buried in concrete or under roadways, suspended overhead or applied in any required manner. Amongst railway applications already undertaken in France are the electromagnetic brakes, power and control circuits of P.L.M. railcars, signalling equipment for C.F. de L'Est, creosote shop wiring and control of points for the C.F. de L'Etat, and carriage lighting for Lyons tramways. The National Opera House in Paris has Pyrotenax wiring for power and lighting, and in Great Britain a good many industrial and private installations have already been carried out.

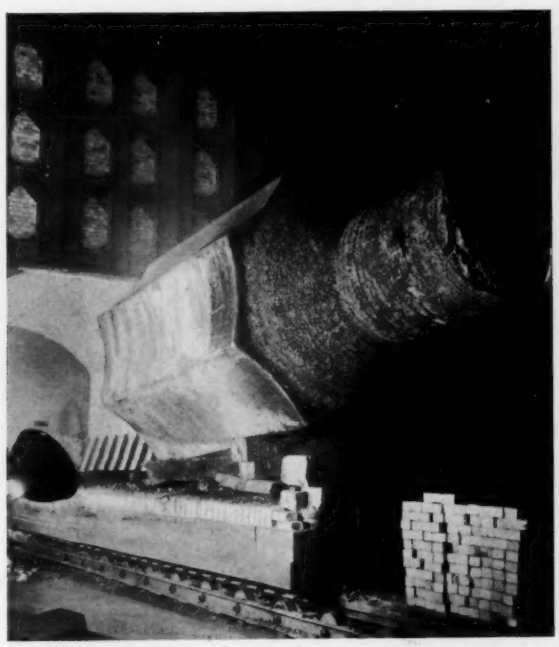
The new factory is equipped entirely with British-made machinery and is now in full production; indeed, extensions are already being discussed. It is naturally wired throughout with Pyrotenax cables and visitors to the opening ceremony were able to inspect many interesting installation features. In the case of some of the machine tools the makers had already provided conduit for wiring; the substitution of Pyrotenax demonstrated how very much more neatly this could be applied and the two systems were retained side by side for inspection by visitors.

Short Wave Wireless Equipment on Norwegian Goods Trains

AFTER some months of experiment, the Norwegian State Railways have equipped their goods trains running between Trondheim and Storlien, on the Swedish frontier, with short wave wireless apparatus to enable the guard to communicate with the driver during shunting operations. Some such facility has long been felt desirable, as the trains run through the narrow and winding Meraker valley and are frequently of considerable length, making it difficult for the driver to see the hand signals of the guard. Foggy weather and heavy snowfalls in autumn and winter make it necessary for the guard to go to the engine whenever a wagon has to be shunted. The wireless apparatus consists of a short-wave sender in the guard's van and a receiver on the engine with the necessary aerials, as seen in the accompanying photographs. Signals given by the guard are acknowledged by whistle. Short-wave apparatus has been used for a similar purpose on certain American goods trains and also for communicating with shunting engines in large hump yards, both in Europe and America, and has been suggested as a means of enabling the guard to signal his arrival to the signal box at places where it is impossible for the signalman to see the tail lamp.

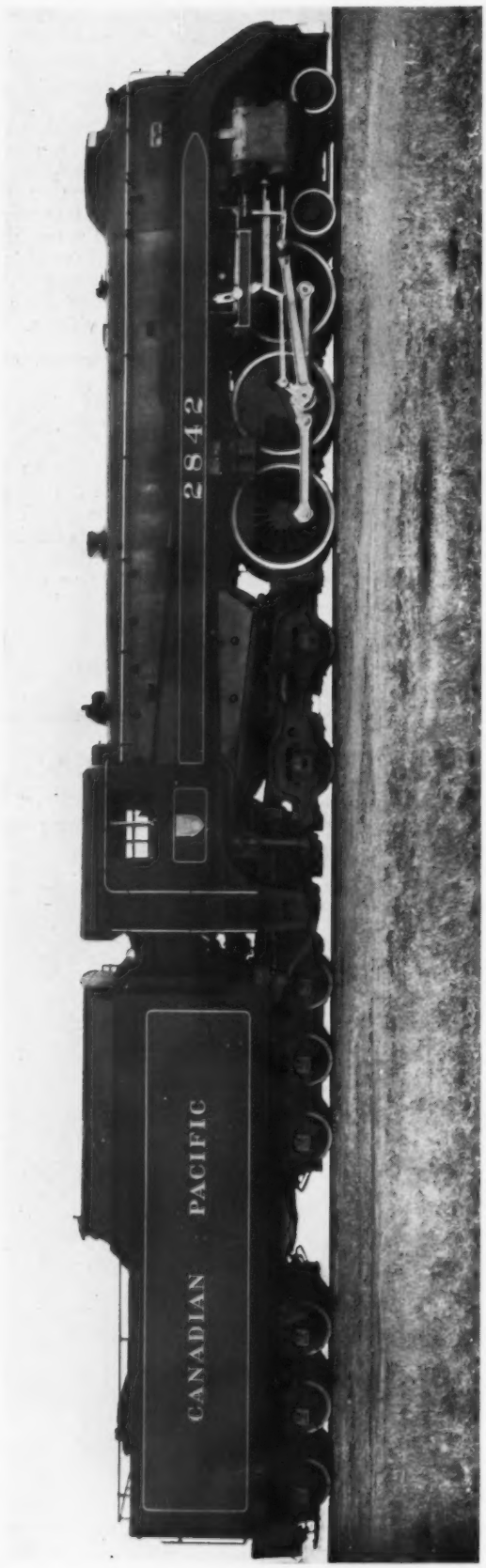
Locomotive and guards van on the Norwegian State Railways, showing short wave wireless aerials. On the left a "shunting prohibition" and colour light signal

Largest Ingot Produced in Great Britain



As noted in our issue of October 8, the English Steel Corporation has, this year, broken its record of 1932, by producing an ingot weighing 230 tons. The ingot, measuring 25 ft. long by 10 ft. across corners, is seen entering the reheating furnace at the Vickers works

XUM



New 4-6-4 type semi-streamlined mixed traffic locomotive, Canadian Pacific Railway

NEW SEMI-STREAMLINED LOCOMOTIVES, CANADIAN PACIFIC RAILWAY

Introduced for high-speed service with long-distance passenger and freight trains

ON page 3 of THE RAILWAY GAZETTE dated July 2 reference was made to some new 4-6-4 type semi-streamlined locomotives then being built by the Montreal Locomotive Works for the Canadian Pacific Railway, and we are now enabled to reproduce a photograph of the first engine to be completed, No. 2842. The designs were prepared by the Motive Power Department of the railway company, and 30 engines are being constructed to the requirements of Mr. H. B. Bowen, Chief of Motive Power and Rolling Stock. The engines have been introduced for hauling heavy trains over long distances without change, and five of them, Nos. 2838-2842, are equipped with the latest design of locomotive booster. These will be used between Toronto and Fort William, a distance of 813 miles, without changing engines, whilst others will be placed in service on through runs of 832 miles between Winnipeg and Calgary and other long runs under like conditions.

The leading dimensions are as follow:—

Cylinders, dia.	22 in.
Piston stroke	30 in.
Wheels, coupled, dia.	6 ft. 3 in.
Wheelbase, coupled	13 ft. 2 in.
,, engine	39 ft. 6 in.
,, engine and tender	80 ft. 6¼ in.
Boiler, heating surface :	
Tubes and flues	3,509 sq. ft.
Firebox and arch tubes	352 ,,
Total evaporative	3,861 ,,
Superheater	1,640 ,,
Combined heating surfaces	5,501 ,,
Grate area	80·8 sq. ft.
Boiler pressure	275 lb. per sq. in.
Tractive effort	45,000 lb.
Tractive effort with booster	57,000 lb.
Weight on coupled wheels	83 tons (long) 7 cwt.
Weight, engine total (with booster)	163 ,, ,, 8 ,,
Weight, engine and tender	294 ,, ,, 8 ,,

These locomotives in their design incorporate features developed by the Canadian Pacific Railway in the first "2800's," as well as features of the "Jubilee" type of 4-4-4 engine. The cylinders, frames, valve motion, and other details, are the same as before, but the new locomotives have a new and positive type of air reversing gear, whilst the arrangement of cab fittings has been made more convenient for operation and access. The boilers have adequate capacity to supply the steam required for heavy fast through passenger trains. The engines will also be used for hauling heavy freight trains at high speed. The wheels for the bogies and all the tyres of the locomotive are supplied by a British firm, namely, Steel, Peech & Tozer, of Sheffield.

Although it is not so stated in the communication we have received from the Canadian Pacific Railway, it is assumed that the tenders of these engines are similar to those of the previous classes above referred to, with a water capacity of 12,000 gallons and a coal capacity of 21 tons; the weight of these tenders in working order is about 130 tons.

THE DEMOLITION OF LLANBRADACH VIADUCT, G.W.R.

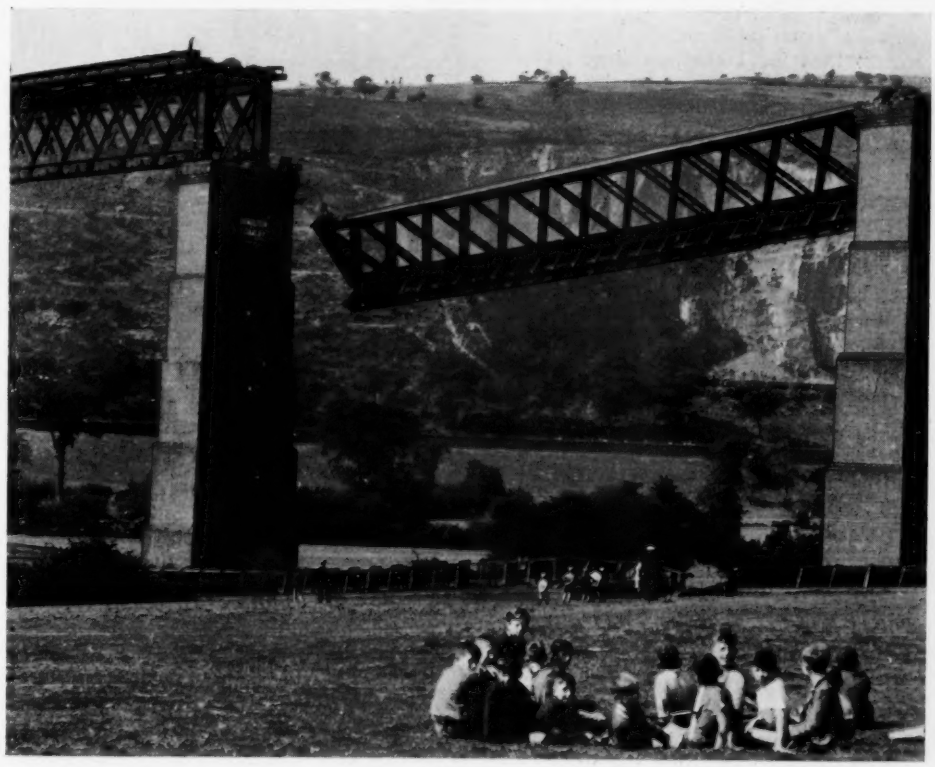
A 2¾-mile structure on the Rhymney branch of the former Barry Railway

THE demolition of Penyrheol viaduct, briefly described on pages 990 and 991 of our issue of May 21 last, has been completed, and work is now proceeding with the dismantling of an even larger structure, namely, the 2¾-mile Llanbradach viaduct, on the same portion of the Rhymney branch of the former Barry Railway.

Llanbradach viaduct, carrying a double line over the Rhymney valley, was built by the Barry Railway Company in 1904, at a cost of £250,000. It consisted of sixteen spans, eleven of 162 ft. and five approach arches of 36 ft. with an adjoining steel bridge over the former Rhymney Railway. The steelwork was of the deck type of construction, every span consisting of two main girders, approximately 17 ft. deep, on which the steel cross girders, rail bearers, and floor rested. The main girders, weighing about 90 tons each, were carried on brick piers, the highest of which was about 90 ft. The total weight of steel used in the structure was about 3,150 tons.

Photo] [Western Mail

The old Barry Railway viaduct spanning the Rhymney valley near Llanbradach



Photo] [V. C. Hardacre, Llanbradach

One of the main girders of the former Barry Railway viaduct, Llanbradach, being crashed to earth in course of the work of demolition

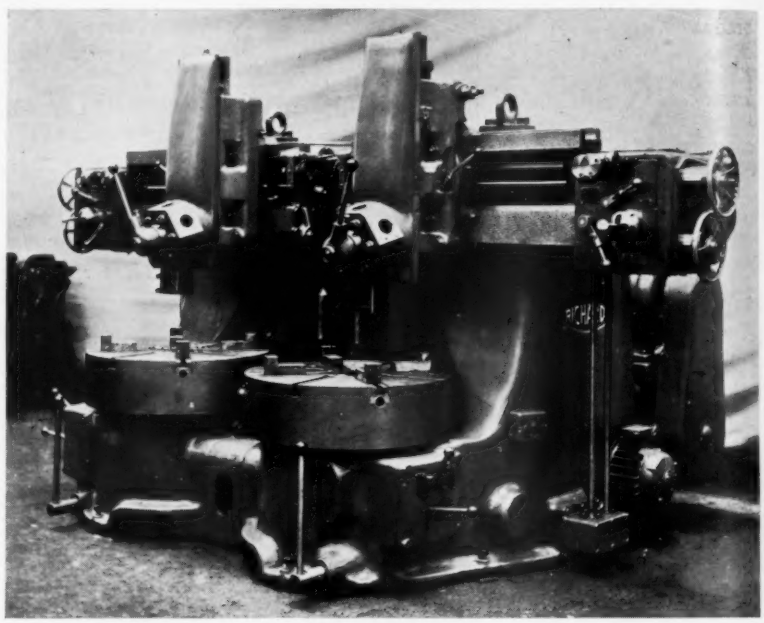
Six of the sixteen spans have already been dismantled. The method being adopted in the demolition is to burn off first as much of the steel decking as possible, allowing the material to fall to the ground below; the girders are then tilted outwards by jacks on top of the brick piers until they overbalance and fall to the ground. They are then cut by oxy-acetylene burners, where they lie, into pieces small enough to handle. Fortunately, the formation of the valley is such as to permit of G.W.R. motor lorries being driven on to the site, and the steel hauled to Caerphilly and Llanbradach stations for dispatch by rail. About a hundred tons of steelwork is loaded and dispatched every week. The work of demolition has been entrusted to Mr. Thomas Oakley, of Luton, under the supervision of Mr. A. W. Hollingdale, Divisional Engineer at Cardiff of the Great Western Railway.

A NEW DUPLEX BORING AND TURNING MILL

The Richards 36-in. machine

THERE is wide scope for boring mills both in locomotive and rolling stock building and repair works, and many advances have been made in the design and construction of this class of machine during the past several years. The speed and convenience with which work can be turned out, and the accuracy assured, are factors which combine to make the boring mill one of the most useful tools to be found in railway shops, and just recently there has been added to the range the duplex machine shown in the accompanying illustration. This is the latest addition to the range of Victor mills first introduced by the firm of George Richards & Co. Ltd., of Broadheath, Manchester, a few years ago.

In this new model, the two heads and tables are entirely independent of each other, so that when both are in use simultaneously the feeds and speeds need not necessarily be the same. Work up to 38 in. dia. can be dealt with on each of the 4-jaw independent chuck tables, and the left-hand table is provided with reversing motion by means of electrical control to the main motor; thus for boring, drilling, and reaming, right-hand tools can be used for both units. Each table is driven by a separate 20-h.p. constant speed motor; Vee ropes are used for transmission to the gearbox. Twelve speeds are provided, ranging from 6 to 120 r.p.m., and controlled by two levers at the front end of the base. A lever adjacent to those used for changing speed, starts and stops the machine, and also applies a very effective brake. All gearing is interlocked, and gear changes cannot be made until the clutch is disengaged.



Duplex turret head boring and turning mill

The drive to the table is by large diameter steel spur gear and double housed pinion. The gearbox clutch is of the latest multi-plate type, and the transmission from this is through bevel wheels to sliding gears, and then from further bevels to the table pinion. Ball or roller bearings are fitted throughout the transmission, and inspection covers are provided for convenience in adjusting the clutch and for general examination purposes.

The table bearing consists of a long parallel spindle of large diameter, having an annular thrust bearing of white metal. The construction of this bearing ensures that the spindle is always kept central, and enables heavy loads to be mounted on the table. The turret is of hexagon shape and is released, rotated, indexed, and re-locked by single lever. The turret slide is balanced by counterweight and can be swivelled for taper boring and turning, the swivel slide being fitted with accurate indexing mechanism. Setting blocks are provided, and these enable the turret to be positioned exactly over the centre of the table, but the head can pass beyond the centre without any obstruction when required. Rules and verniers are provided to the down side, and also to the movement of the saddle horizontally along the cross slide by means of which adjustment to within 0·001 in. can readily be made. Eight rates of feed, ranging from 0·006 in. to 0·243 in., are provided to the turret, and these can be applied vertically, horizontally, or angularly. The feedbox containing the sliding feed gears is mounted at the end of the cross-slide, and this box also houses the friction clutches for the rapid power motion.

All high-speed shafts run in ball or roller bearings, and hand feed is also available to all motions, obtained through handwheels at the end of the feedbox; micrometer dials enable adjustments to 0·001 in. to be made with ease. The rapid power motion has separate drive, with push-buttons for starting and stopping, and this device is engaged and controlled entirely by the patent lever on the front of the feedbox. Movement of this lever in any direction gives corresponding movement to the saddle or turret slide; thus, if the lever is moved to the right, the saddle will travel in the same direction, whereas if the lever is moved downwards, the turret slide will also move downwards. Interlocking renders it impossible for the rapid power motion to be used when the feed is engaged. All slides are of the narrow guide type, and automatic lubrication is provided to the main bearings and driving gears, with bath lubrication to the feed and rapid-traverse box.

This appears to be a very excellent design for a machine of its kind, and inspection shows the workmanship exhibited in its construction to be of the highest class.

REDUCING PLATFORM NOISE ON THE L.N.E.R.—In a further effort to reduce noise at important stations, the L.N.E.R., which has already fitted solid rubber tyres to 365 of its platform barrows, now proposes similarly to equip a further 476 vehicles, which are to be allocated between King's Cross, Marylebone, Liverpool Street, Norwich, Peterboro', Grantham, and Doncaster stations.

MODERN SECOND CLASS ACCOMMODATION IN GERMANY

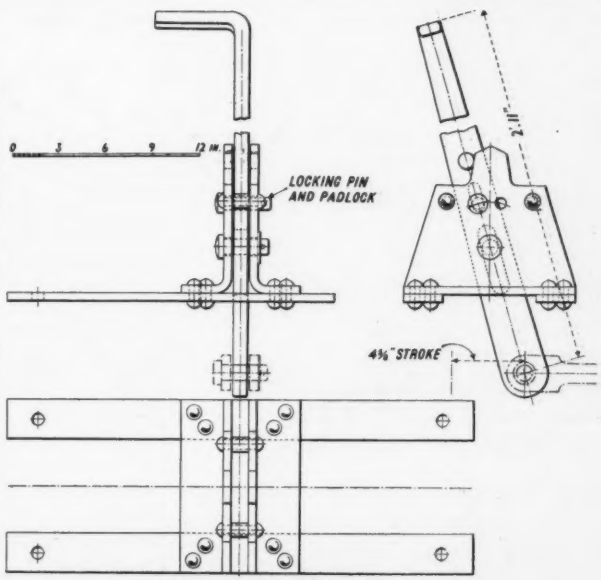
WE illustrate on this page an interior view of a second class compartment in the present standard main-line corridor stock of the German State Railway. The comfortable design of the seats, with their well-sloped backs, will be noted. The large plate-glass window can be lowered completely by pulling the handle at the top or by means of the winding handle behind the folding tables below the window. This winding handle is used also for raising the window to any required position. It will be observed that the draught-excluding cloth across the lower part of the window can be adjusted to any height, an advantage over the former fixed type. This cloth is used, of course, only in winter. Other features to be noted are the small folding tables provided for the two window seats and also for the seats next the corridor, access to which is by double sliding doors; the folding arm rests; the hat and coat hooks; the ample luggage racks; and the good lighting arrangements. These vehicles have dual steam and electric heating for use respectively in steam or electrically hauled trains.

The latest German first class accommodation is similar to that provided for second class passengers, except that instead of being three aside the seats are arranged for two aside, and have movable bolster-type arm rests. They also have certain additional amenities, such as individual reading lamps for each passenger. In the third class the severity of the old bare boards has been replaced by modestly upholstered and more comfortably shaped seats.

New Point Lever

A NEW type of point lever has recently been placed on the market by the Monarch Controller Co. Ltd., of 7, Victoria Street, London, S.W.1, the novelty of which consists of its completely fabricated construction of mild steel, ensuring lightness combined with strength and, since no cast iron is used, eliminating the risk of breakage. In principle the lever is identical with that described in THE RAILWAY GAZETTE of November 3, 1933, the main advantages of which are the automatic lock and the automatic absorption of slackness in rodding, &c.

This lever has a minimum number of working parts and is therefore specially suitable for private sidings and crossing loops on light and colonial railways. The working parts consist of the base, pin and lever. A second pin, the upper of the two, is for hand lock-up purposes and is an optional fitting. When padlocked in place it prevents the lifting of the lever, so avoiding any unauthorised movements thereto. We understand that some of these levers are in use on the London Midland & Scottish Railway.



PLAN (LEVER OMITTED)

The first joint railway ticket and parcels office, completed as a result of an open competition for British architects, which has been opened by the four main-line railway companies at 162, Queen's Road, Bayswater (*see page 744*)

Three views of Great Southern Railways (Ireland) station gardens, showing their attractive appearance as now improved, the result of the competition described in our Overseas columns on page 722

RAILWAY NEWS SECTION

PERSONAL

At the meeting of the Railway Statistics Committee held on October 19, Mr. G. Morton, Assistant Accountant of the London Midland & Scottish Railway, was unanimously re-elected Chairman of the committee for the ensuing twelve months.

From the *London Gazette* of October 15: Regular Army, Supplementary Reserve of Officers; Royal Engineers; Transportation: Mr. R. F. J. Smeardon to be 2nd Lieutenant (October 16).

Mr. H. K. Bostock, Superintendent of Motive Power and Equipment, Nigerian Railway, has arrived in England on leave.

Mr. W. J. Gibbs, of the executive staff of R. A. Lister & Co. Ltd., Dursley, has, by arrangement with his firm, joined the board of A.C.E. Machinery Limited — which manufactures hoists and industrial equipment—as this undertaking has standardised Lister engines as prime movers for its products. Mr. Gibbs takes up his new duties forthwith.

The death, on October 17, is announced of Mr. Bruce Ismay, at the age of 74. In 1899 he succeeded to the control of the White Star Line, and in 1904 became President and Managing Director of the International Mercantile Marine Company, in which the White Star Line was included. He retired from the board in 1916. Mr. Bruce Ismay was a Director of the former London & North Western Railway, and until July last was a Director of the L.M.S.R.

Mr. Frank E. Fehr, C.B.E. (Chairman, Baltic Exchange) was the principal guest at the annual dinner of the National Lubricating Oil and Grease Federation, which was held on October 20 at Grosvenor House, under the presidency of Mr. E. B. Irwin. Others present included Prof. J. S. Brame, C.B.E., Sir William Kay, Mr. R. Hooper Beck, Mr. W. Smellie, Mr. A. J. Singleton, Mr. H. R. Cobb, Mr. Jas. Todd, Mr. N. Usmar, Mr. Geo. McBurney, Mr. J. W. Waugh (Vice-President of the federation), Mr. J. Rennie, Mr. H. D. Gotts, Mr. Jas. Arnott, and Mr. V. H. Stott.

We regret to note the recent death of Mr. J. H. Williams, a former Chief Engineer of the Canton-Hankow Railway, at the age of 63.

The King has conferred the honour of Knight Commander of the British Empire upon His Excellency Mahmoud Shaker Mohamed Pacha, General Manager, Egyptian State Railways, Telegraphs and Telephones.

His Excellency was born in 1887 and obtained the diploma of the Royal School of Engineering of Egypt in 1910, later completing his studies at Leeds University. He began his career in the Irrigation Department of the Ministry of Public Works, being entrusted with the diversion of the course of the Nile at Asyût Barrage, and in 1914 was appointed Irrigation Engineer, Fourth Circle. Promoted to be Assistant Director of Works in 1919, he became Director of Works in 1921, and two years later was nominated Deputy Surveyor General, one of the highest technical appointments in the Egyptian Government; he was the first Egyptian to hold this post, which he did with distinction for over two years. In 1924 he was elected President of the delegation representing the Egyptian Government at the Madrid International Congress of Geodesy and Geophysics. In 1925 His Excellency was selected as Under Secretary of State for Communications, the post he held until he was promoted to his present post at the beginning of 1933. He was Chairman of the committee appointed to frame new laws for road transport and inland navigation, and was Vice-President of the Cairo Session and a member of the Permanent Commission of the International Railway Congress. His Excellency's tenure of office as General Manager has been marked by an energetic policy of progress and development, including the introduction of diesel railcars to combat road competition and provide economical services, cheap excursions and reduced fares, co-ordination of road and rail services, and also by the interest he has shown in the improvement in the conditions of the subordinate staff.

H.E. Mahmoud Shaker Mohamed Pacha

General Manager, Egyptian State Railways, Telegraphs and Telephones, who has received the Honour of K.B.E.

Mr. E. J. Evans, of Guest, Keen, Williams Limited, Calcutta, will take up residence in Birmingham for three months from November 1, and will be attached to the Service Department of British Timken Limited, manufacturer of tapered roller, ball, and parallel roller bearings, at Cheston Road, Aston, Birmingham, 7.

Mr. R. H. Hacker, who, as announced in our issue of October 22, has been appointed Deputy Assistant for Continental Traffic, Southern Railway, was educated at Dover College, of which he has recently been elected a Governor. He entered the Goods Manager's Office of the former S.E. & C.R. in 1909, but was transferred to the Continental Traffic Manager's Office in the following year. At the outbreak of the war he was transferred to the Gare Maritime, Boulogne, in connection with S.E. & C.R. work at that port. Subsequently, on receiving a commission in the Army, he served on the Mediterranean Lines of Communication in France and Italy. After the war Mr. Hacker returned to the Continental Department at London Bridge under Mr. F. A. Brant, and attended some of the first International Conferences on the Continent regarding the resumption of through booking arrangements subsequent to the war. At the time of the amalgamation in 1923, he was placed in charge of the international fares and traffic section of the Southern Railway Continental Department, and was subsequently promoted to be head of the passenger section of that office. At the beginning of 1937 Mr. Hacker was appointed Chief Clerk of the Con-

Elliott] [& Fry

Mr. R. H. Hacker

Appointed Deputy Assistant for Continental Traffic, Southern Railway

tinental Department, at the same time retaining his charge of the passenger section, and it is from Chief Clerk that he is now promoted to be Deputy Assistant.

Mr. P. W. Pine, who, as announced in THE RAILWAY GAZETTE of October 15, has been appointed Common Law and Chancery Assistant, Solicitor's Office, G.W.R., entered the company's service on November 29, 1915. Eleven months later he was appointed Assistant, and in September, 1919, was given charge of the County Court and Prosecutions Department. On the retirement of Mr. Stephen Witherinton on September 4 last, Mr. Pine was appointed Common Law and Chancery Assistant, with effect from September 6.

Mr. R. H. B. Nicholls

Appointed Assistant Divisional Superintendent, Paddington, Great Western Railway

During recent years he has undertaken the conduct of litigation in the Superior Courts and Courts of Appeal in anticipation of his new appointment, and he still retains control of prosecutions.

Mr. R. H. B. Nicholls, whose appointment as Assistant Divisional Superintendent, Paddington, G.W.R., was recorded in our issue of October 15, entered the company's service in the General Manager's Office in 1919, immediately after being demobilised from the Army. Two years later he was transferred to the Divisional Superintendent's Office at Paddington, and in 1925 to the Office of the Superintendent of the Line as a passenger train runner. In 1926, Mr. Nicholls represented the Great Western Railway at the Baltimore & Ohio Exhibition at Baltimore, and he subsequently performed duties

Mr. P. W. Pine

Appointed Common Law and Chancery Assistant, Solicitor's Office, G.W.R.

in the company's New York office. In 1932 he was appointed Chief Clerk to the Divisional Superintendent at Gloucester, and in December, 1934, became Assistant Divisional Superintendent at Cardiff, which position he now leaves to come to Paddington.

Mr. H. H. Swift, who, as recorded in our issue of October 15, has been appointed Assistant Divisional Superintendent, Cardiff, G.W.R., in succession to Mr. Nicholls, entered Great Western service at Paddington in 1904. After two years in the Audit Office he was transferred to the General Manager's Office, where he was engaged for a period of nine years, during the latter part of which he acted as personal clerk to the General Manager. For the next seven years Mr. Swift was attached to the Superintendent of the Line's office as a train runner, and subsequently transferred to the Chief

Elliott] [& Fry

The late Lieut.-Col. H. A. Hull

District Engineer, Northampton, L.M.S.R., 1923-33

Goods Manager's office and appointed Continental Commercial Agent. This position he held for six years, when he was appointed Goods Agent at Manchester. Four years later Mr. Swift returned to the Traffic Department and was appointed Chief Clerk to the Divisional Superintendent, Chester, the position he has now relinquished.

It is with regret that we record the death on October 23, at the age of 68, of Lieut.-Col. Henry Adin Hull, who from 1923 to 1933 was District Engineer, Northampton, L.M.S.R. Col. Hull will also be remembered as the author of a book entitled "Railway Maintenance Problems" published by THE RAILWAY GAZETTE in 1936, following serial publication in our pages. Be-

Mr. H. H. Swift

Appointed Assistant Divisional Superintendent, Cardiff, G.W.R.

ginning his career some 50 years ago as a pupil at Bow locomotive shops of the North London Railway, Col. Hull subsequently went to Euston as a pupil to the Chief Engineer of the London & North Western Railway. After experience in the drawing office, he was appointed Assistant Resident Engineer on the Daventry—Leamington construction. Subsequently, he was promoted Resident Engineer in charge of the northern section of the Ashbourne—Buxton construction, on which there were many heavy works. Col. Hull's next duties included charge of various widenings on the Trent Valley line and the preparation of schemes for others. While supervising the construction of the Coventry avoiding line, he became a Member of the Institution of Civil Engineers, having previously been a Student and then an Associate Member. During the war he recruited, trained, and took into action a Territorial Battalion of the North Staffordshire Regiment, and, after being invalided, commanded a Railway Construction Company in France. On his return he became Divisional Engineer, Rugby, L.N.W.R. and, upon the amalgamation, his charge became the Northampton District of the L.M.S.R., from which he retired at the end of 1933. A memorial service was held at the Parish Church, Long Buckby, on Tuesday.

R.O.D. Annual Re-Union Dinner

Numerous old R.O.D. Officers have expressed a wish that the annual dinner should not be allowed to lapse owing to the death of their late Commanding Officer. A small committee has been formed to consider what arrangements should be made this year, and it has been agreed that:—

1. The dinner should take place at the Trocadero Restaurant (Oak Room) at 7.30 for 8 p.m. on Friday, November 12, and Colonel Speir has agreed to act as Chairman.

2. Invitations should be confined to purely R.O.D. Officers together with Officers of the Railway Signals and those of the Railway Construction who were closely associated with the depot at Audruicq, also a limited number of railway officers who were closely associated with the formation of the Division and who have always been guests of the late Colonel at previous dinners.

Captain R. M. T. Richards, Development Officer, Southern Railway, is acting as Honorary Secretary of the dinner, and any old R.O.D. Officers not on his list who may be interested, are invited to write to him at Waterloo station, London, S.E.1.

The late Mr. Joseph Xavier Murphy, a Director of the Great Southern Railways, whose death on October 12 was recorded in our issue of October 22, was formerly a partner of Palgrave Murphy & Company, and was for some time T.D. for Dublin County. He became a Director of the former Great Southern & Western Railway in 1923, and on amalgamation of the Irish railways was elected to the board of the present Great Southern Railways. He was also a Director of the Fishguard and Rosslare Railways and Harbours Board, the Bank of Ireland, the Dublin Gas Company, the Hibernian Insurance Company, Irish Cinemas, the Merchants' Warehousing Company, and the National City Bank.

We regret to record the death on October 22, at the age of 87, of Mr. Frank Hudson, General Manager of the Central Uruguay Railway from 1899 until his retirement in 1906. Prior to his appointment as Acting General Manager in 1894, Mr. Hudson had been Chief Mechanical Engineer of the company.

Luncheon to Mr. J. B. Elliot

To mark the appointment of Mr. J. B. Elliot (formerly Assistant Traffic Manager) to the position of Assistant General Manager of the Southern Railway, his brother officers of the Traffic Department entertained him to luncheon at the Charing Cross Hotel on October 20, those present including Mr. E. J. Missenden (Traffic Manager), Mr. R. M. T. Richards (who has succeeded Mr Elliot as Assistant Traffic Manager), Mr. H. E. O. Wheeler (Superintendent of Operation), the principal assistants to the Traffic Manager, and the divisional traffic superintendents. The luncheon was of a very informal and happy nature. Mr. Missenden, who presided, spoke in terms of the highest appreciation and praise of the harmonious relations which had existed between Mr. Elliot and the other officers of the Traffic Department throughout his career with the Southern Railway, and especially during his connection with the Traffic Department. He paid tribute to the sterling qualities displayed by Mr. Elliot; not the least of which were his sound judgment and readiness to do everything possible to further the interests of the Southern Railway and its relations with the travelling public. Mr. Missenden offered heartiest congratulations to Mr. Elliot on his important appointment, and on behalf of all present wished him every success. Messrs. H. E. O. Wheeler, C. Cooper (Continental Assistant) and C. J. C. Latham (London Central Divisional Superintendent) endorsed the sentiments expressed by Mr. Missenden. Mr. Elliot, in response, spoke in humorous vein of the valuable knowledge he had gained during his connection with the Traffic Department, and expressed sincere thanks for the generous support he had received from all in that department. The opportunity was taken to welcome and to offer congratulations to Mr. R. M. T. Richards (formerly Development Officer) on his appointment as Assistant Traffic Manager, and to express the pleasure of all present at his return to the Traffic Department.

The directors of the L.M.S.R. announce that in consequence of ill health, Mr. Ernest Taylor is to retire from the position of Chief Accountant of the company on October 31, and that Mr. George Morton, the Assistant Accountant has been appointed Chief Accountant, and Mr. Charles H. Sutherland Assistant Accountant.

Sir Herbert Walker, formerly General Manager of the Southern Railway, and Mr. Charles F. Whigham have joined the board of United Steel Companies Limited.

Mr. S. J. Hungerford, Chairman and President, and Mr. M. A. Metcalf, Assistant to President, Canadian National Railways, are returning to Canada tomorrow (Saturday) by the *Empress of Britain*.

We regret to record the death on October 26, at the age of 75, of Alderman Maxwell Hyslop Maxwell, C.B., C.B.E., Chairman of the Liverpool Overhead Railway Company, and a Traffic Commissioner for the North-Western Area.

We regret to record the death, on October 14, of Mr. E. S. Tiddeman, who retired in 1926 from the position of Chief Draughtsman, Chief Mechanical Engineer's Department, Stratford, L.N.E.R. He joined the Great Eastern Railway as a pupil under the then Locomotive Superintendent, Mr. T. W. Worsdell. After the usual shop and drawing office experience he was, two years later, appointed assistant in the Millwrights' Department. He remained there until November, 1890, when he was transferred to the Drawing Office staff. In July, 1907, on the retirement of Mr. W. D. Craig, he was appointed Chief Draughtsman. Mr. Tiddeman had thus had a total service of close on 44 years (19 of them as Chief Draughtsman) and served under five Superintendents, namely: Messrs. T. W. Worsdell, James Holden, S. D. Holden, A. J. Hill, and C. W. L. Glaze. He was responsible for the design of locomotive, carriage, and wagon stock built at Stratford, also accident cranes, and was very closely connected with the work of the Railway Clearing House, more particularly in connection with the committees of Chief Mechanical Engineers and Carriage & Wagon Superintendents. Mr. Tiddeman was responsible for several inventions, including the electro-mechanical automatic train control system tried on the Seven Sisters branch and the Epping and Ongar lines, which, had the Great Eastern remained a separate entity, would probably have been further installed; his other inventions related to spark arresters and tender water-gauges. Mr. Tiddeman was a descendant of Edmund Spenser, the illustrious man of letters, and a nephew of Mr. C. E. Spooner, one time Engineer and Manager of the Festiniog Railway.

XUM

Lord Horne's Presidential Address to Railway Students' Association

The inaugural meeting of the Railway Students' Association for the session 1937-38 was held at the London School of Economics and Political Science on Thursday, October 21. Owing to the detention in Scotland of Mr. William Whitelaw, the retiring President, his place in the chair was taken by Brig. Gen. Sir Osborne Mance who was supported by the following:—

Messrs. O. H. Corble (Assistant to Chief General Manager, L.N.E.R.), C. E. R. Sherrington (Secretary, Railway Research Service), W. Tetley Stephenson (the London School of Economic.), Col. H. H. Mauldin (Superintendent, Eastern Section, L.N.E.R.) and Prof. A. M. Carr-Saunders (Vice-Presidents of the Association); Messrs. R. Carpmael (Chief Engineer, G.W.R.), J. C. L. Train (Assistant Engineer, L.N.E.R.), A. E. Tattersall (Signal and Telegraph Engineer, Southern Area, L.N.E.R.), Col. L. Manton (Principal, L.M.S.R. Staff College), Messrs. G. F. Boxall (Stores Superintendent, G.W.R.), W. S. Every (Signal Engineer, L.P.T.B.), G. Morton (Assistant Accountant, L.M.S.R.), L. W. Orchard, H. Bailey, A. F. Wallis, and S. E. Bellamy (Officials of the Railway Students' Association).

Among others present were:—

Messrs. J. Dewar (Publicity Officer, G.W.R.), George Stephens (Chief of Police, G.W.R.), C. T. Cox (London Divisional Superintendent, G.W.R.), A. H. Peppercorn (Locomotive Running Superintendent, Southern Area, L.N.E.R.), C. F. Slade (District Engineer, King's Cross, L.N.E.R.), A. Winter Gray and F. Crews (Secretary and Assistant Secretary, respectively, Institute of Transport), C. F. King, and F. E. P. White.

Sir Osborne Mance introduced the President-Elect, the Rt. Hon. Viscount Horne of Slamannan, Chairman of the G.W.R., who then took the presidential chair.

Lord Horne began by expressing his thanks, speaking in terms of generous appreciation, for the tribute paid to him in his election as President of the Railway Students' Association. He divided his presidential address into two main subjects, "General Managership," and "Parliamentary Legislation and the Railways."

A General Manager, he said, has got an extraordinary series of duties to perform. His qualifications have to be varied, his mind orderly, and documented. He has got to be a sufficient technician so that he can talk with authority with the heads of various departments. In addition he must be a business man. He has got to deal with a great army of men, and there was nothing so elusive as human psychology. He must have a sound knowledge of finance, and has to be something of a politician and be able to understand the diverging ways of politicians. He has to deal with Parliamentary Committees and understand how Parliament works. He must be a statesman; and finally, he must have the ability to plan for the future.

Speaking on the relations of railways with Parliament, Lord Horne said that the railways were the creation of Parliament. They were born, nurtured, and trained in Parliament, which acting in a parental capacity to them had, like many parents of earlier days, a heavy hand, and often the railways suffered very much. At the beginning, he said, railways were looked upon with no favour at all in this country. He quoted some of the derogatory notices which railways received in their early days, and followed up by describing some of the steps taken against them by persons or bodies usually of great importance, whose positions should have endowed them with a far greater wisdom. Scholastic institutions in particular regarded the new railways with great suspicion.

After this awkward beginning, Lord Horne continued, a new attitude was taken up towards railways, as a result of their proved success. Time would not allow him to mention the forest of committees set up between 1830 and 1845 after it was decided that railways were definitely to be encouraged. The landmarks of railway legislation from that time up to the present day were then briefly commented upon. In 1845, he said, three important Acts of Parliament were passed—the Railways Clauses Act, the Lands Clauses Act, and the Companies Clauses Act. These Acts obviated the need for the multitudinous clauses which it was necessary to append to every railway Bill coming before Parliament—for instance one Bill had no fewer than 341 of these clauses to it! In 1846 the Gauge Commission sat to consider the merits of the broad and narrow gauge, and the findings of this commission were responsible for the restriction and eventual disappearance of broad gauge lines in this country. In 1863 a committee was set up to make arrangements for co-operation between the railways—a step which resulted finally today in the common working of most of our great systems.

On the subject of rates Lord Horne said that railways were controlled from the beginning in the matter of rates. Before the railways, canals were so controlled. Rates had to be published and as common carriers the railways could not discriminate between traders. In 1888 and 1894 laws were passed which fixed the maximum charges which the railways could levy for various classes of goods and merchandise. If they wished to raise a rate they had to give adequate reasons in justification. These provisions were replaced by an Act of 1921 introducing standard charges, which could be varied on application to the Railway Rates Tribunal. It was the Act of 1933 that authorised the present system of Agreed Charges, which enabled certain traders with a large volume of traffic to agree upon special rates with the railways which had to be submitted to the Railway Rates Tribunal for approval. Any trader who thought he was entitled to the benefits of these charges could apply to the Tribunal. This type of legislation was a distinct and welcome departure from the strict and rigid rules previously enforced.

Dealing with the appearance of road motor transport and road and rail competition, Lord Horne remarked that the road haulier then possessed very great advantages. His wings were clipped, however, by the bringing into operation of a licensing system, but Lord Horne maintained that the restrictions imposed were not far-reaching enough. Road hauliers could still choose their traffic and were not compelled to publish their rates, furthermore, knowing the railway rates, which had to be published, they could and did undercut. Describing this as unfair, Lord Horne pointed out the serious consequences to the country if the railways were permanently to be enfeebled by such competition.

Commenting on the recent recommendations of the Transport Advisory Committee on goods services and rates (see THE RAILWAY GAZETTE, October 22) Lord Horne said he hoped as a result to see the railway authorities and road hauliers come to a satisfactory agreement. He thought the railways would support the proposals which the Transport Advisory Council had made, and was in great hopes that, when fresh legislation was passed the railways would get rid of those great difficulties which had so embarrassed and irritated them. He looked forward to a future in which all forms of transport in this country would be co-ordinated and acting together for the benefit of the country and the trader.

In conclusion, he said, the history of railways was also a great record of excellent work achieved for the general welfare. Far too much unthinking criticism was levelled against railways by people who did not understand their difficulties, though reasonable advice from outside was undoubtedly appreciated. He congratulated the builders of the great national services which had performed such a great part in the advancement of this country. Those who served upon the railways served one of the institutions upon which the whole welfare of the country depended.

A vote of thanks to Mr. William Whitelaw for his services as President during the Session 1936-37, and to Lord Horne for his presidential address, proposed by Sir Osborne Mance, and seconded by Mr. O. H. Corble, was carried with acclamation.

SPECIAL TRAVEL STAMPS IN AUSTRALIA.—At any post office in Australia it is now possible to obtain special stamps—valued at 1s. and 5s.—which may be saved and exchanged, through the travel agencies, for holiday tickets, available all over the world as well as throughout the Commonwealth, states a Reuters message from Melbourne.

Institution of Railway Signal Engineers: Annual Dinner

The 17th annual dinner of the Institution of Railway Signal Engineers was held in London on Friday, October 22, under the chairmanship of the President of the Institution, Mr. H. M. Proud, Chief Commercial Engineer, Westinghouse Brake and Signal Co. Ltd. There was a large attendance, and Mr. Proud was supported by:—

Mr. G. H. Crook, Vice-President; Messrs. A. F. Bound, C. Carslake, W. Challis, F. Downes, W. S. Every, R. S. Griffiths, H. E. Morgan, J. W. Punter, W. S. Roberts, and W. Wood, Past-Presidents; Messrs. J. Boot, F. L. Castle, F. J. Dutton, H. H. Dyer, C. H. Hills, W. R. Jones, L. J. M. Knotts, R. F. Morkill, A. Moss, A. Oldham, F. H. D. Page, F. Horler, and H. W. Moore, Members of Council; Mr. M. G. Tweedie, Honorary Secretary, and Mr. T. S. Lascelles, Honorary Treasurer.

The guests of the institution were Sir George Lee, O.B.E., President of the Institution of Electrical Engineers and Engineer-in-Chief to the Post Office, and Mr. W. K. Wallace, President of the Permanent Way Institution, Chief Civil Engineer, L.M.S.R.

Sir George Lee proposed the toast of "The Institution" and pointed out that he was in some measure a signal engineer as the Post Office was responsible for a certain amount of railway signal work. The safety of British railways was remarkable, thanks largely to the activities of the signal engineers. Co-operation between the various engineering institutions would, Sir George hoped, be more extensively cultivated so that the vast funds of knowledge and experience accumulated therein might be made more generally available.

Mr. H. M. Proud, responding, thanked Sir George Lee for his kindness in attending and reminded him that it was the track circuits of the signal engineer which had enabled the Post Office railway to be worked automatically with such success. The institution was only too glad to further any proposals for co-operating with other bodies, making library collections accessible, and sharing experience. They would assuredly follow the lead given by Sir George and were grateful to the Institution of Electrical Engineers for the facilities given them to use its building.

Mr. G. H. Crook, Vice-President, proposed the toast of "Overseas Members," and alluded to the admirable manner in which Mr. Proud had piloted them on the summer meeting cruise. The overseas members were held in high esteem by the home members, who desired to see the bonds between them strengthened and the work carried out abroad more widely known.

Mr. S. Starkey, Signal Engineer, South African Railways, replied, suggesting that overseas members might be represented on the council. The work of the home body and the proceedings were followed with attention overseas, and he had been much impressed with the advance made in British signalling in recent years. He would carry back to South Africa the happiest recollections of his visit.

Mr. F. H. D. Page, Member of Council, proposed "The Ladies and Visitors"; they were happy to see their distinguished visitors, Sir George Lee and Mr. Wallace; he would also like to mention Mr. Le Clair, Vice-President of the Institution of Locomotive Engineers. Mr. Wallace was responsible for the "best permanent way in the world," which was having to stand up to more severe requirements every day, and he had constantly to consider how to meet the increasing demand for faster rail travel.

Mr. W. K. Wallace, replying in a characteristic speech, said that such praise of his permanent way from a Great Western man must be taken as confirmation that it was indeed the best in the world. Permanent way and signal engineers were jointly interested in the provision of high speeds. Co-operation between all concerned in the common work of carrying on and improving railway communication was a most laudable object which they should strive to promote.

The dinner was followed by a dance, at which music was provided by an orchestra from the L.N.E.R. Musical Society; Mr. C. H. Hills, Member of Council, acted as M.C. During the evening a series of films taken during the summer meeting cruise in September was shown.

Institute of Transport: Metropolitan Graduate and Student Society

On Tuesday last a reception was held by the President of the Institute of Transport, Sir Alexander Gibb, on the occasion of the inaugural meeting of the winter session of the Metropolitan and Graduate and Student Society, a virile section of the institute. A full attendance of members was present, including the Chairman and Vice-Chairman of the society and the energetic Honorary Secretary, Mr. C. F. King, together with several members of the institute council, the Secretary, Mr. Winter Gray, and others.

At the subsequent meeting Sir Alexander, who prefaced his remarks by expressing his pleasure at the opportunity given him of addressing the younger members of the institute, said that while the only advice usually followed by a man was that indicated by his own experience, much could be learned from the careers of famous men. He cited the examples of two eminent engineers of the past, Telford and Watt who, born in humble circumstances and favoured with little education, were yet able, by their energy, perseverance and ability, to make their mark in the world. For true success in life, which of course meant far more than getting rich, character was of equal, if not greater, importance with technical skill.

Transport, continued Sir Alexander, was of growing importance in the world of today, and those among them who could help to make it cheaper and more rapid would render a great service not only to this country but to the world. Another direction in which there was a crying need for improvement was in the safety of the road where, in spite of every effort, official and otherwise, the casualty list was still from 6,000 to 7,000 dead and 200,000 injured every year. A disturbing feature in regard to this was the complacency with which such a holocaust of human lives was regarded. The rare occasion of a railway accident, or a mining disaster, in which 10 or 20 people lost their lives, was sufficient to send a wave of horror throughout the country, and yet 19 lives were lost every day on the roads without exciting much attention.

In conclusion Sir Alexander said that the future of transport was in the hands of his hearers. It was the young man who had the imagination necessary for the task and the energy to carry it out. A society such as the graduates and students possessed in London and other centres enabled men of all branches of transport to get together and to understand each other's difficulties and points of view, which could not fail to be of benefit. A hearty vote of thanks to the President for his inspiring address was proposed by the Chairman of the Society (Mr. G. Barker), and seconded by the Vice-Chairman (Mr. Foster).

PROPOSED SCIENCE MUSEUM ENLARGEMENT.—At a recent meeting of the Grand Council of the Federation of British Industries, Mr. A. P. M. Fleming, who represents the federation on the Advisory Council of the South Kensington Science Museum, appealed for the support of the F.B.I. for certain recommendations which the advisory council was making to His Majesty's Government with a view to the enlargement of the museum. The federation approved of the case made out for increased space, and a letter has been sent to the President of the Board of Education strongly supporting the recommendations of the advisory council. In an editorial note on page 715 we refer to the development of the Science Museum and to the present extension proposals.

Messages from the Retiring and New General Managers, Southern Railway

In connection with the retirement of Sir Herbert Walker from the General Managership of the Southern Railway, and the appointment of Mr. Gilbert S. Szlumper to succeed him, messages to the staff have been issued in the following terms:—

The General Manager's Farewell

GENERAL MANAGER'S OFFICE,
WATERLOO STATION

On my retirement from the service of the Southern Railway, I should like to thank all members of the staff for the courtesy and support they have always accorded to me.

During my 26 years as General Manager—firstly with the old L. & S.W. Company and latterly with the Southern Railway—it has always been a pleasure for me to work with the staff, in the knowledge that one and all they appreciated the progress that has been achieved in the conveyance of the travelling public and the freight entrusted to us, and the steps that have been taken in the interests of the welfare and comfort of the staff.

I thank you all, and wish you success and happiness.

H. A. WALKER

Message to the Staff

GENERAL MANAGER'S OFFICE,
WATERLOO STATION,
October 15, 1937

As it is not physically possible for me, on entering upon my responsible duties as General Manager of the Southern Railway, to have a word with each of you, I have to put in writing my desire that our association shall be a mutually happy and successful one, for we each have as our object the progress of the Southern Railway and the continuance and extension of the team spirit which has so much helped it attain its present position.

In Sir Herbert Walker we have had a leader of outstanding qualities, a man of ability, patience and justice in superlative degree, whose name will be written high up on the scroll of great General Managers, and I now ask and rely on each one of you to help me in my difficult task of following such a leader.

Happily I am no stranger to railway work, having been "born and bred" on one of the constituent companies of our railway; and having worked alongside all grades in the course of my training I can claim to know something of the outlook and aspirations and difficulties of all ranks—in a word, to be in sympathy with every genuine worker.

Sometimes I wonder if we do not tend to lose sight of the object of our daily work: put briefly it is to run our railway so efficiently that it may pay for our employment and may produce a reasonable return to our partners the stockholders who have, by supplying the money needful for building, equipping, extending and improving the railway, provided the means for that employment—such a return, indeed, as will attract and justify them in supplying more money as and when required for further improvements and extensions, so enabling more workers to earn a livelihood.

To enable this to be done we have each and all to work for the marketing of our commodity—TRANSPORT—and if we sell better transport and make it increasingly attractive to the public, our business will expand and we will all benefit from the prosperity of our line.

But be it always remembered we are servants of the public and must give them efficient, reliable and safe transport, for after long experience the public take for granted our reliability and safety—we must never fail them or break faith with our predecessors who have built up the magnificent record that the Southern Railway holds.

Let us therefore all be mindful of this record and make even more effective *service to the public* our goal and in our endeavour to attain it let us all work together with enthusiasm and energy, let us aim at greater and yet greater efficiency, let us be tactful, industrious and cheerful, let us make a daily effort to find new customers and to do nothing to lose existing ones, let us avoid preventible damage to those who entrust themselves or their goods to our care, as well as preventible accidents to ourselves, let us remember that half our waking hours are spent at work and that it is a duty to be happy and to spread happiness among our fellow men during work-hours as well as during play-hours, let us remember that a healthy mind can only exist in a healthy body and let us therefore follow harmless and health-giving recreations, let us readily give a hand to a fellow worker who needs help or encouragement, remembering that we can get no more out of life than we put into it.

We of the Southern Railway are noted for our team work, a team is as useless without a captain as a captain is without a team: the Directors have done me the honour of appointing me to be your captain—I know that I can rely on you to work not merely *under* me but *with* me so that our object may be achieved.

GILBERT S. SZLUMPER

British Railways: New Town Office

The first "British Railways" ticket office, which has been completed following an open competition for British architects, was opened on Monday, October 18, by the four main-line railway companies at 162, Queen's Road, Bayswater, London. A photograph of the exterior is reproduced on page 738. This new office has been evolved for the convenience of the public in order to associate the title "British Railways" with railway travel facilities and services, and by adopting a modern note in design and decoration a striking result has been obtained. The office is an experiment to ascertain the reaction of the public both to centralisation of the four main-line railway companies' ticket and parcels facilities, and also to the new design. The shop front is constructed of sheradized steel, cellulosed, and with vitrolite riser; the outside lobbies are lined with shot blasted slate. The interior walls are decorated with posters of the four main-line railways in stainless steel frames, and a similar type of fitment is available for the display of small literature. All hardwood is wax polished. The shop is comfortably furnished for the use of the public, and has a wide glass-topped counter. A feature of the office is a separate and wide entrance at the rear from Queen's Road for the reception of parcels and goods. The double doors leading into this section are of beaten iron, evolved after investigation into the effect of barrows and merchandise upon other types of doors. The walls of the parcels and goods receiving office are lined with glazed tiles, and the floors are of maple; a convenient counter is provided for public use. The agent's office is also fitted up in the rear. The artificial lighting throughout is reflected from the ceiling by means of wall brackets.

The fitting up of this new office has been carried out from designs by Mr. H. T. Cadbury Brown, A.R.I.B.A., in collaboration with the Chief Estate Manager of the L.M.S.R., Mr. W. H. C. Clay, F.S.I. The contractor for the shopfitting work was Barnes Limited, Peterborough Road, Fulham, S.W.

HIRE YOUR OWN RAILCAR AT 1S. A MILE, WITH CHAUFFEUR.—A private railcar may now be hired in Victoria for 1s. a mile, this rate including a uniformed chauffeur, who will drive the hirer anywhere he wishes to go on the Victorian railway system. The railcar is actually a smart saloon motorcar fitted with steel flanged wheels which enable it to run on the railway lines. The Railway Department hopes that this form of travel will become popular.

STAFF AND LABOUR MATTERS

Holidays with Pay

The Minister of Labour, in the House of Commons on Thursday, October 21, stated that he estimated that the number of workpeople now covered by collective agreements between organisations of employers and workpeople which provide for paid holidays is between 2,500,000 and 2,750,000. The Minister added that there has been an increase in the number of individual firms giving holidays with pay. Among the notable recent additions to the list are, of course, the main-line railway companies in respect of their workshop staff, and the engineering employers. Particulars were given in these columns some weeks ago of these concessions by which a very considerable number of workpeople will enjoy paid holidays next year. It is understood that the committee appointed by the Minister to study and report on the question of holidays with pay in industry generally has not yet concluded taking evidence.

Road Transport Wages

Several references have been made in these notes recently regarding a claim for increased wages and improved conditions of service made to the Joint Industrial Council covering tram, bus, and trolleybus men employed by municipally-owned undertakings in the provinces. On September 24 it was stated that the position was to be considered by a sub-committee, and on Thursday, October 21, it was announced that a provisional agreement had been reached.

As we are going to press we learn that recommendations have been submitted to the Municipal Tramways and Transport Association and the trade unions for adoption of 2s. a week flat rate pay increase for adult workers; 1s. for those under 21; and paid holidays. These recommendations are likely to be accepted. These are some of the recommendations of the National Joint Industrial Council for the road passenger industry to improve the conditions of 60,000 drivers, conductors, and garage employees working on municipal tram, trolleybus, and motorbus services in the provinces.

The terms provide, for the first time, for one composite agreement on conditions of service. The agreement deals with hours of labour, provides for the continuance of the guaranteed week, for a minimum payment for a call-out, for overtime, and special rates of pay on Sundays and Bank holidays. For the first time, too, minimum conditions of payment are set out in the agreement. Annual holidays with pay are provided for on the following lines: after twelve months' continuous service, not less than eight days; after two years' continuous service, not less than ten days; and after three years' continuous service, twelve days. The agreement, it is proposed, should come into operation from the beginning of the first full pay period in December.

Road Transport Wages: New Legislation

The Speech of H.M. The King, delivered on Tuesday last, October 26, on the occasion of the Opening of Parliament, made a reference to the impending introduction of legislation to "regulate wages and conditions of employment in the transport of goods by road." It will be recalled that a committee, under the chairmanship of Sir James Baillie, was appointed by the Ministers of Labour and Transport in July, 1936, "to examine the present position in regard to the regulation of wages and conditions of service of persons employed in connection with the carriage of goods by road (whether in vehicles authorised under 'A,' 'B' or 'C' licences), and to make recommendations as to the action which it is desirable to take." A considerable volume of evidence was taken from numerous interests, including the four main-line railway companies, and the report of the committee was issued in May, 1937. The text of the Bill to give effect to certain recommendations of the committee will be certain to arouse considerable discussion.

Labour Statistics

The Ministry of Labour has just published (Cmd. 5556, H.M.S.O., price 3s. 6d.) the Twenty Second Abstract of Labour Statistics. This admirable volume brings together statistics relating to labour matters in the United Kingdom in the period 1922 to 1936. The figures are presented in fourteen main sections dealing respectively with population; employment, unemployment, and insurance; wages and hours of labour; profit-sharing and co-partnership; wholesale and retail prices and cost of living; strikes and lock-outs; employers' associations and trade unions; co-operative societies, building societies, and friendly societies; national health insurance; widows', orphans', and old age pensions; industrial accidents and diseases and workmen's compensation; poor relief; migration; and building plans approved. The book is invaluable to all who have to study and deal with staff and labour matters.

Selling Transport on the L.M.S.R.

Every salesman on the staff of the L.M.S.R. will shortly receive a little blue-and-yellow booklet entitled, "Salesmanship—and you!" Altogether 10,000 are to be issued in England, Scotland, and Wales. The booklet, which has been compiled by Mr. Ashton Davies, the Chief Commercial Manager, contains hints upon how to sell transport. The successful salesman, says Mr. Ashton Davies, must have the following qualifications:—

Be neat, tidy, and businesslike,
Possess self assurance,
Cultivate a comfortable personality,
Have a sense of humour, and
Study the social activities of his clients.

The booklet, in addition to being distributed to the 400 whole-time salesmen who represent the L.M.S.R. interests in England and Wales, will also be circulated to a large number of other grades including stationmasters, goods and parcels agents, booking and enquiry clerks, and others whose duties bring them into contact with the public. This booklet is part of the L.M.S.R. sales campaign, which includes the quota competition, whereby all the goods and passenger districts compete in friendly rivalry, and in connection with which trophies and shields are presented to the winners at the end of every year's working.

All grades of the staff have entered into this scheme with remarkable enthusiasm, with the result that new business is being secured not only by the professional salesmen but also by men of such grades as porters, carters, engine-drivers, and signalmen. For instance, in his spare time a Lancashire signalman was successful in promoting party travel to the value of £50 in the vicinity where he lived; a West Country clerk sold holiday tickets amounting to £15 when playing bowls; and a Scottish goods loader, in his leisure moments, has organised excursions which have yielded over £1,000 worth of traffic to the L.M.S.R.

In sending out the new sales booklet to the staff, Mr. Ashton Davies has addressed to every recipient a personal letter which concludes: "The welfare of the L.M.S. is a matter which affects each and every one of us, and I feel sure this little booklet will be of assistance to you in your labours."

SOUTHAMPTON DOCK CHARGES.—The Southern Railway Company gives notice of alterations as from November 1 in some of the rates and charges at Southampton docks. Import and export rates at present below the statutory maxima will be increased by 7½ per cent., as will also extra charges for additional services. In warehousing charges the deduction of 10 per cent. where now allowed will be cancelled and charges at present shown as net figures will be increased by 10 per cent. On rates of rent on goods the deduction of 10 per cent. where now allowed will be cancelled, and in charges for use of cranes the present allowance of 20 per cent. will be reduced to 10 per cent. Charges for dock haulage (where separately charged) will be increased by 7½ per cent.

RAILWAY AND OTHER MEETINGS

South Indian Railway Co. Ltd.

The annual general meeting of the South Indian Railway Co. Ltd. was held at 91, Petty France, Westminster, on October 27, Sir Ernest A. S. Bell, Chairman and Managing Director, presiding. The Assistant to the Managing Director (Mr. C. A. Worsfold) read the notice convening the meeting and the auditors' report.

The Chairman in moving the adoption of the report and accounts first of all referred to the greatly regretted death of Mr. Thomas Wake. Sir Vivian E. D. Jarrad had been appointed to fill the vacancy on the board. Referring to the report of the Indian Railway Enquiry Committee, the chairman said that stockholders might be interested to learn what action the company was taking as regards what he considered to be the committee's two main recommendations. As regards development of the commercial activities of the railway, a re-organisation scheme had been under the consideration of the board and the Agent before the receipt of the committee's report, and effect had since been given to it. Under this scheme the Commercial Department had been considerably strengthened and beneficial results were expected. With reference to road competition a good deal was still required to put rail and road competition on a fair basis, but it had been announced in the Indian press that a Bill had been drafted as an outcome of the committee's proposals, and this was now under consideration by all parties concerned, and in this connection two officers of the Government of India had been making a tour of India for the purpose of studying the conditions of control and regulations of road transport. It was to be hoped that this question would in the near future be brought to a satisfactory conclusion both as regards rail and road transport. The company was fortunately in the possession of powers to run road services and also to acquire a financial interest in existing road undertakings.

He told the stockholders last year that stage 4 of the Cochin Harbour scheme had been sanctioned, and work on this was now in full swing. The actual terminus was on an island, and it was necessary to construct a short railway line, some 4½ miles long, including a long bridge over the backwater, to connect with the Shoranur-Ernakulam branch.

During the last financial year, the Chairman continued, the Deputy Chairman, Sir Percy Rothera, had paid a visit to the railway, travelling over a large part of the system. He investigated a great number of questions, and submitted reports to the board which had proved very useful. Mr. Bruce G. White also paid a visit of inspection, and submitted reports on Trichinopoly workshops, Madras electrification, Diesel railcars, and general subjects.

Last year the Railway Board agreed to the provision of 8 additional diesel railcars. The company's consulting engineers had studied this matter very carefully, and as there were certain inherent difficulties in the design of a suitable car to meet the railways' needs, the whole matter was still under consideration. First class accommodation on the Madras electric suburban section had been abolished, and increased accommodation in the two lower classes provided. A seven-minute service was operating with 150 trains daily as against 90 previously.

Coming to the report and accounts for the financial year ended March 31, 1937, the Chairman stated that the capital outlay on the open line during the year amounted to Rs. 20·17 lakhs. There had been an increase of Rs. 14·03 lakhs in gross earnings. In volume of traffic last year over a million more passengers were carried and over 146,800 tons more public merchandise than in the previous year. Working expenses had increased by just over Rs. 1·29 lakhs, there being a decrease of nearly Rs. 1·16 lakhs in ordinary working expenses and an increase of Rs. 2·45 lakhs on account of renewals and replacements, the percentage of working expenses to gross earnings being lower at 61·26 per cent. as against 62·78 per cent. last year, which might be regarded as satisfactory. The net earnings after certain adjustments were Rs. 196,67,038, or just over Rs. 12·30 lakhs more than the previous year. The company's share of surplus profits after providing for Indian taxes amounted to Rs. 70,282, the equivalent of about £5,299 which, together with the guaranteed interest and interest received on investments, gave an available income attributable to the year of 4·24 per cent.

Proceeding, the Chairman said that as regards dividend, although the result of last year's working was a decided improvement over that of the previous year, the board regretted that it had again to recommend a reduction in the year's dividend from 5½ per cent. to 4¾ per cent. The surplus profits account stood as at March 31 last at a little over £48,700, and in order to pay the reduced dividend now recommended it would be necessary to draw £5,000 from this account. As the company's contract had still 8 years to run, it would clearly be unwise to draw more heavily on surplus profits at present. With regard to the current year's working, *i.e.*, 1937-38, the Agent reported by cable that the gross earnings up to the end of September amounted to Rs. 2,58,67,000 as against Rs. 2,48,55,000 in the corresponding period of last year, an increase of rather over 10 lakhs. There had been a saving in working expenses, and the company's share of surplus profits for the half year were estimated at Rs. 1,47,000, which compared with an actual figure of Rs. 30,175 for the corresponding half of last year. The year had, he said, therefore begun auspiciously.

The report and accounts were unanimously adopted.

Buenos Ayres Great Southern Railway Co. Ltd.

The annual general meeting of the Buenos Ayres Great Southern Railway Co. Ltd. was held at River Plate House, Finsbury Circus, London, E.C.2, on October 27, Sir Follett Holt, K.B.E., Chairman of the company, presiding.

The Secretary (Mr. N. F. E. Grey) read the notice convening the meeting and the auditors' report.

The Chairman, in moving the adoption of the report and accounts, said that due in a large measure to somewhat improved climatic conditions in the company's zone, and to the wave of prosperity which Argentina was enjoying, they were fortunately able to present more encouraging results than were possible at their meeting last year. The outstanding feature of the present report to his mind was that the increase of £1,070,000 in receipts entailed an increase of only 8·15 per cent. of that amount in working expenses, this low ratio being attributable in a great measure to the success of the plan initiated four years ago to combine the working of the Southern and Western systems. The task of welding two great organisations together would have been no light one even in our own country; in Argentina it was not lessened and all credit was due to the company's representatives and chief officers and staff who with human understanding and skill had achieved the desired result.

To those proprietors who might have lost heart, and not without some cause, it would be encouraging to know that the total amount of business handled by the railway during the year when measured in ton-miles was a record in its history. The Great Southern continued to be a very virile undertaking with only one trouble, a major one it was true, namely that it did not receive at present a living wage for its services. Although they had passed through distressingly bad times the physical assets of the company remained well cared for and preserved. To keep pace with road competition they had quite a large number of diesel-driven passenger units now under construction in England, their passenger cars were being modernised in the company's own workshops, and the train

service was being accelerated in all directions. The outlay in new plant and equipment was being defrayed from their present resources. He mentioned that as he knew shareholders were definitely opposed to any new British capital being raised until confidence had been restored in the safety of that already invested in the great Argentine public utility companies.

He would also draw shareholders' attention to the large amount of working capital employed in stores and materials, which was certainly over a million pounds in excess of what they would like it to be. This excess arose through the contracts made for track materials for renewals, which had been deferred, and also to complete a series of extension which, when the crash came in 1930, were definitely abandoned by mutual agreement with the Argentine Government. However, these materials were now being gradually absorbed in renewals and improvements, and having been paid for no cash would be required on that account. They had been able to increase the 1 per cent. of the previous year to the full amount on the 5 per cent. preference stock, and to pay 3 per cent. on the 6 per cent. preference stock instead of nothing. After providing for these payments the company was free from any floating indebtedness to its bankers or elsewhere.

The results of the year, however, left in effect 36 millions of the capital unremunerated, or, in other words, in round figures, 50 per cent. of their total capital received full remuneration, and 50 per cent. received no remuneration at all. This result was not considered in keeping with the resources and progress of Argentina, which had turned round in the one single year from depression to prosperity. Foreign indebtedness had been reduced, internal and external loans had been converted to a lower rate of interest, the budget had been balanced, and large sums had been allocated to public objects and public works.

The Co-ordination of Transport Bill, so necessary for the orderly development of the country, became law in January last, and although preparatory work had been done, its actual application had remained in abeyance pending the nomination by the Government of the Chairman of the Controlling Board, which he was glad to say had now been made. Other questions which affected the railway industry, such as the rate of exchange where it concerned foreign capital, and tariff modifications, had not materially progressed on account of the exigencies of the presidential election which was held on September 5; there was now much more chance of consideration being given to these all-important problems than there had been for many months past. The President Elect, Dr. Roberto Ortiz, himself a Moderate, was formerly Minister of Finance, and his successful financial work for his country at that ministry augured well for the future.

Apart from the crop failures, the special calamity from which the railway had suffered since 1934 had been exchange. The railway, and business, were built up in the main on the basis of 11·45 pesos being worth £1. Last year, based on actual remittances, the company required 15·94 pesos to purchase each £1, this being 3·2 per cent. better than in the previous year, but even this rate of 15·94 represented a loss on their remittances of 28 per cent. It might be that the Government, with a rapidly increasing favourable balance of trade, would loosen the control of exchange and permit a more normal rate to obtain, but in any event the company would continue to press its claim for special consideration and for other urgent measures.

They had again to thank their colleague Mr. Eddy for the services he rendered during his stay in Argentina during the year. Between the various British-owned railways, and they all worked closely together, such representative visits were frequent, and these, together with the rapidity of the air mail services, were very helpful in keeping in close touch with the Government authorities and the progress of events.

As to the future, they must hope that receipts would improve. Making an allowance for the increased cost of materials and for the expenditure on renewals, if exchange remained where it was and nothing unforeseen happened, he thought that with an increase of about 7·4 per cent. in gross currency receipts they would cover their fixed charges, including preference dividends, and that an additional 5 per cent. should about cover 1 per cent. on the ordinary stock. A message from the General Manager reported prospects of an abundant harvest. Construction material prospects were exceptionally good, and general merchandise was expected to be higher. Passenger movement was steadily on the up grade.

The report and accounts were unanimously adopted.

Buenos Ayres & Pacific Railway Co. Ltd.

The annual general meeting of the Buenos Ayres & Pacific Railway Co. Ltd. was held at Winchester House, Old Broad Street, London, E.C., on October 28, the Rt. Hon. the Viscount St. Davids, Chairman of the company, presiding.

The Secretary (Mr. C. E. Rich) read the notice convening the meeting and the auditors' report.

The Chairman, in moving the adoption of the report and accounts, said he wished to allude first to the death of Dr. Videla, their lawyer in Buenos Aires for many years and later for a long term a Member of their Local Board. He was a man of really immense ability, and had a great knowledge of railway affairs not only in Argentina but in many other countries of the world, and his knowledge and experience were recognised to be such that his opinion was valued not only by them, but by the Government and people of Argentina.

Full interest had been paid on the company's first and second debentures on the due dates. Three payments had been made each of one half year's interest on the 4½ per cent. consolidated debentures and Argentine Great Western 4 per cent. debentures arrears. The board considered the position allowed the distribution, to be made on December 1, of a further half year's interest.

Total profit for the year to June 30 was £1,120,000, and the company's loss on exchange was £752,000, amounting to 40 per cent. of the total profits. Wages had increased with the depreciation of the currency, and the railways were hit in that way too. They had watched the peso go down from 11·45 to 17 to the pound, and they had hoped for better times. They had waited four years, while facts had eloquently shown the effect of the exchange situation upon them. The Argentine Government would have to take a decision affecting the future of their country. Could they afford to let their railways sink into a state of starvation and neglect? The company looked forward to the new Government under Dr. Ortiz.

The country had had a very prosperous year, and the expansion of trade was reflected in their receipts, but had at the same time entailed higher expenses. For the current year the cost of fuel was bound to be higher owing to the increased price of coal; and wages were not likely to be any less. In connection with the Government's scheme of installing grain elevators at ports and producing centres, 13 elevators and 27 granaries were to be erected on the company's lines.

Discussing prospects, the Chairman said the wheat harvest in the company's zone might be no worse than last year despite earlier poor expectations. In general, they might have as good a year as last, but he thought they would be very lucky indeed if results were much better.

He thought it would be only a matter of a term of years before the Government bought all the Argentine railways. The financial affairs of the country were carried on with quite unusual ability, and the country's credit enormously improved. In a few years its credit might be as good as ours. Argentina could buy their company by buying off their high-paying debts, and still leave something satisfactory for the ordinary stockholder.

The report and accounts were unanimously adopted.

NOTES AND NEWS

New Light Refreshment Service, G.W.R.—Beginning on Monday, November 1, a car for the service of light refreshments will be provided by the G.W.R. on the train leaving Worcester (Shrub Hill) station on weekdays at 8.55 a.m., and Oxford at 10.10 a.m., for Paddington.

German Diesel Trains.—Several of the high-speed diesel trains of the German State Railway have been replaced, temporarily it is believed, by steam trains. This matter is commented on in the *Diesel Railway Traction Supplement* presented with each copy of this issue of THE RAILWAY GAZETTE.

Swiss Loan to French Railways.—The loan of 200,000,000 Swiss francs by a group of Swiss banks to the French railways having been fully subscribed, the lists were closed last Friday night, October 22. The issue price of the bonds was 99 and the rate of interest is 4 per cent.

Roumanian Stations Renamed.—The names of certain railway stations in Roumania have been altered as follow:—

Former Name	*New Name*
Decebal	Curtici
N. Titulescu	Halmein
Grigore Ghica Voda	Oaseni
General M. Ionescu	Neptun
G. H. Buzdugan	Faracani
I. Gh. Duca	Babeni
N. Filipescu	Faurei
Vasile Lupu	Tg. Ungheni

Welded Tenders.—The Czechoslovak State Railways have put into service some double-bogie tenders with a coal space of 9 tons and a water capacity of 6,600 gal., which, apart from the bogie frames, are entirely of welded steel construction; the bogie frames are vanadium steel castings. Built by the Skoda works, these tenders tare 21¾ tons.

Freight Rebates Scheme Review.—As will be seen from the legal notice published on page 751, the Railway Rates Tribunal will sit at 10.30 a.m. on Wednesday, November 17, in London to review the operation of the Railway Freight Rebates Scheme for the year ending September 30, 1937. The railway companies have filed an application that in respect of the year October 1, 1937, to September 30, 1938, the sum to be paid out of the Freight Rebates Fund for administrative expenses shall be 1 per cent. of the estimated rate relief of the companies for that period.

Named Expresses to Atlantic City.—Twenty-four Camden-Atlantic City expresses of the Penn-Seashore Lines have been given names since September 26. A selection of these, which are now applied to nearly all expresses on this 55-mile route, are quoted in an editorial note on page 715. The Penn-Seashore trains are worked by the Pennsylvania and the Reading Railroads, which recently amalgamated their services between Camden and Atlantic City, building a new joint terminal at Atlantic City and operating over a common route, instead of by their independent main lines as previously.

Rome Underground Scheme Abandoned.—We understand that the scheme for an underground railway system in Rome has now been abandoned owing to the prohibitive cost of the undertaking. It was referred to in our issues of February 19 and March 26 last.

Higher Passenger Fares Authorised by I.C.C.—The Interstate Commerce Commission has authorised the South-Eastern Railroads to increase their passenger fares from 1½ to 2 cents a mile. It was also announced on October 21 that the Southern railroads had decided to raise passenger fares from 1½ to 2 cents a mile with effect from November 1.

End of Royal Tour of Yorkshire.—The Royal tour of the King and Queen in Yorkshire ended with their departure from Sheffield (Midland) station for Euston on Thursday, October 21, last. The train, composed of the L.N.W.R. Royal coaches, hauled by two standard compound locomotives, left Sheffield at 5 p.m., but the scheduled allowance of 3 hr. 35 min. for the 168 miles to Euston was exceeded by 12 min. owing to fog encountered *en route*. The route followed was *via* Trent, Leicester, Market Harborough, and Northampton; a stop was made at Market Harborough for locomotive purposes.

Fast Manchester-Glasgow Goods Service.—The fastest railway freight service from Manchester to Glasgow ever provided is given by a new express goods train which the L.M.S.R. has recently introduced. Leaving Manchester (Ancoats) at 8.40 p.m., the train arrives Glasgow (Buchanan Street) at 4.50 a.m. The introduction of this service, which is intended solely for goods for delivery in the Glasgow city area, has been made possible by the increased goods traffic from Manchester to Glasgow, resulting from the improvement in trade. We understand that so far the response to the new service has been very satisfactory.

Northern Ireland Traffics.—Passenger receipts for the first seven months of 1937 on railways wholly in Northern Ireland amounted to £171,529, against £164,501 for the corresponding period of 1936, although the number of passengers (excluding season-ticket holders) fell from 3,414,135 to 3,412,659. Merchandise and mineral tonnage for the seven months fell from 368,797 tons to 347,904 tons, and the total goods traffic receipts from £135,556 to £127,206. Railways partly in Northern Ireland carried 3,105,195 ordinary passengers in the first seven months of 1937, against 3,232,433 for the corresponding period in 1936, but total passenger receipts rose from £251,408 to £262,995. The quantity of merchandise and minerals carried fell from 559,611 tons to 549,096 tons, and total goods traffic receipts from £369,898 to £364,334. On the purely northern railways the number of live-stock carried in the first seven months of 1937 rose from 109,525 to 143,822, and on the cross-border railways from 416,196 to 444,396.

Daily Argentine Railway Strike.—With a view to ending the twice-daily one-hour strikes that began on October 15 on the Cordoba Central Railway, the Argentine Minister of Public Works, Dr. Alvarado, ordered the management to restore the services within 48 hr., on pain of penalty, and to instruct its staff accordingly. Employees then came out on strike for six hours on October 23.

U.S.A. Enhanced Freight Rates Granted.—The Interstate Commerce Commission of the U.S.A. has granted the higher freight rates on basic commodities, in accordance with the application of the American railways. These rates will serve to raise the revenue of those railways by about £9,500,000 per annum, on the basis of 1936 traffic volume. Further information upon this subject is contained in our American correspondent's notes published in the Overseas columns of this issue, which were, of course, written prior to this news, which has reached this country by telegram.

Finger Tip Control.—To emphasise the easy table control movement of Jones-Shipman cutter and tool grinders, the firm of Jones & Shipman Limited, of East Park Road, Leicester, has produced a "working picture" of one of these machines. The illustration, from a photograph of the 24-in. × 12-in. cutter and tool grinder already reproduced in THE RAILWAY GAZETTE, is printed on card, with the table made movable. Rotation of a cardboard disc causes the table to slide to and fro as if moved by the operator in the picture, and the information is prominently displayed that "a touch of the finger moves the table more easily than it does on this model."

L.M.S.R. (London) Dramatic Society.—On Friday and Saturday of last week this society presented the well-known three-act play, "Theatre Royal" of Edna Ferber and George Kaufman. On this occasion, the society abandoned its customary stage at the Cripplegate Theatre in favour of the Fortune Theatre, Drury Lane. The production was again in the capable hands of Mr. W. F. Humphreys, with Mr. W. W. Sharp as Stage Manager and Mr. E. G. Savage as Assistant Stage Manager. The cast of 17 characters was happily chosen and the performance well maintained the society's enviable reputation. All the parts were skilfully sustained, but the chief honours deservedly went to Miss Marjorie Groves for her outstanding rendering of the part of Fanny Cavendish, the veteran head of the stage family of Cavendish. Membership of the society is open to L.M.S.R. staff, past and present, and also to the wives, sons, and daughters of the staff.

British and Irish Traffic Returns

GREAT BRITAIN	Totals for 42nd Week			Totals to Date		
	1937	1936	Inc. or Dec.	1937	1936	Inc. or Dec.
L.M.S.R. (6,868½ mls.)	£	£	£	£	£	£
Passenger-train traffic...	468,000	440,000	+ 28,000	22,330,000	21,468,000	+ 862,000
Merchandise, &c. ...	545,000	521,000	+ 24,000	20,688,000	20,073,000	+ 615,000
Coal and coke ...	263,000	244,000	+ 19,000	10,618,000	10,012,000	+ 606,000
Goods-train traffic ...	808,000	765,000	+ 43,000	31,306,000	30,085,000	+1,221,000
Total receipts	1,276,000	1,205,000	+ 71,000	53,636,000	51,553,000	+2,083,000
L.N.E.R. (6,315 mls.)						
Passenger-train traffic...	304,000	284,000	+ 20,000	14,607,000	13,958,000	+ 649,000
Merchandise, &c. ...	389,000	369,000	+ 20,000	14,175,000	13,680,000	+ 495,000
Coal and coke ...	268,000	247,000	+ 21,000	10,351,000	9,699,000	+ 652,000
Goods-train traffic ...	657,000	616,000	+ 41,000	24,526,000	23,379,000	+1,147,000
Total receipts	961,000	900,000	+ 61,000	39,133,000	37,337,000	+1,796,000
G.W.R. (3,738½ mls.)						
Passenger-train traffic...	194,000	189,000	+ 5,000	9,393,000	9,130,000	+ 263,000
Merchandise, &c. ...	225,000	210,000	+ 15,000	8,419,000	8,063,000	+ 350,000
Coal and coke ...	117,000	108,000	+ 9,000	4,661,000	4,183,000	+ 478,000
Goods-train traffic ...	342,000	318,000	+ 24,000	13,080,000	12,246,000	+ 834,000
Total receipts	536,000	507,000	+ 29,000	22,473,000	21,376,000	+1,097,000
S.R. (2,157 mls.)						
Passenger-train traffic...	280,000	273,000	+ 7,000	13,975,000	13,289,000	+ 686,000
Merchandise, &c. ...	71,000	70,000	+ 1,000	2,620,500	2,667,000	− 46,500
Coal and coke ...	29,000	32,000	− 3,000	1,246,500	1,277,000	− 30,500
Goods-train traffic ...	100,000	102,000	− 2,000	3,867,000	3,944,000	− 77,000
Total receipts	380,000	375,000	+ 5,000	17,842,000	17,233,000	+ 609,000
Liverpool Overhead ... (6½ mls.)	Returns not to hand.					
Mersey (4½ mls.) ...	4,294	4,276	+ 18	175,799	170,583	+ 5,216
*London Passenger Transport Board ...	570,700	578,300	− 7,600	9,544,000	9,511,700	+ 32,300
IRELAND						
†Belfast & C.D. pass. (80 mls.)	1,706	1,669	+ 37	112,334	113,811	− 1,477
,, ,, goods	538	558	− 20	20,199	22,757	− 2,558
,, ,, total	2,244	2,227	+ 17	132,533	136,568	− 4,035
Great Northern pass. (543 mls.)	10,300	8,450	+ 1,850	481,200	467,350	+ 13,850
,, ,, goods	9,300	9,950	− 650	395,450	410,800	− 15,350
,, ,, total	19,600	18,400	+ 1,200	876,650	878,150	− 1,500
Great Southern pass. (2,076 mls.)	33,223	29,380	+ 3,843	1,579,314	1,562,842	+ 16,472
,, ,, goods	49,322	49,269	+ 53	1,734,962	1,768,857	− 33,895
,, ,, total	82,545	78,649	+ 3,896	3,314,276	3,331,699	− 17,423

* 17th week (before pooling) † 43rd week

RAILWAY AND OTHER REPORTS

Taltal Railway.—The directors recommend the payment of a dividend of 1 per cent. or 1s. a share, less income tax, at 5s. in the £1, for the year to June, 30, 1937.

Bahia Blanca & North Western Railway.—The board reports that the guaranteed rental of £440,000 due from the Buenos Ayres Great Southern Railway Company in respect of the year ended June 30, 1937, has been received and the dividend on the £4,600,000 of 4½ per cent. guaranteed stock has been duly paid. The London office expenses, including directors' fees, have been paid by the working company.

Entre Rios Railways.—The company having recently received from the Argentine Government the balance payable in connection with the expropriation of its Hasenkamp branch, awarded by the Supreme Court in Buenos Aires, the directors have decided to pay on November 5 next, 1½ years' arrears of interest on the 4 per cent. debenture stock, together with the 5 per cent. per annum interest on such arrears as provided for under the moratorium scheme, the total payment per £100 of stock, amounting to £6 18s. 7·1d., less income tax.

Bengal Dooars Railway.—Gross earnings for the year to March 31, 1937, amounted to Rs.17,28,649, a decrease of Rs.1,24,901 in comparison with the previous year. In the working expenses of Rs.10,98,044 there was a saving of Rs.74,390, and net earnings fell from Rs.6,81,116 to Rs.6,30,605. The operating ratio was 63·52 per cent. against 63·25 per cent. Net earnings in sterling, less Indian taxation, were £43,903 against £43,278. Coaching earnings increased by Rs.893, but goods traffic receipts were Rs.1,26,403 lower. From the £75,352 at credit of net revenue account the directors have placed £7,000 to reserve, and propose a final dividend of 3½ per cent., making 6 per cent. for the year, and leaving £54,352 to be carried forward, against £55,111 brought in.

British and Irish Railway Stocks and Shares

Stocks	Highest 1936	Lowest 1936	Prices Oct. 27, 1937	Prices Rise/Fall
G.W.R.				
Cons. Ord. ...	64¼	45½	63¼	+1
5% Con. Prefce. ...	126½	116¾	117½	+1
5% Red.Pref.(1950)	113	108½	110½	—
4% Deb.	119½	110½	106½	—
4½% Deb.... ...	121	114	111	—
4½% Deb.... ...	129	121	116½	—
5% Deb.	141	134	128½	—
2½% Deb.... ...	79⅛	74	69½	—
5% Rt. Charge ...	136½	130	127½	—
5% Cons. Guar. ...	135¼	127¾	124½	+½
L.M.S.R.				
Ord.	35⅝	17	31	+¼
4% Prefce. (1923)	83	52½	74	—
4% Prefce. ...	92¾	81	83	—
5% Red.Pref.(1955)	109¼	103¼	106	—
4% Deb.	111¾	105 9/16	102½	—
5% Red.Deb.(1952)	119⅝	115½	111½*	—
4% Guar. ...	106¾	101⅝	100½	+½
L.N.E.R.				
5% Pref. Ord. ...	14	9	9½	—
Def. Ord.	7¼	4¾	4½	−⅛
4% First Prefce.	79¼	55¼	70½	−½
4% Second Prefce.	31⅞	18¼	27½	−½
5% Red.Pref.(1955)	100½	77¾	99½	—
4% First Guar. ...	104½	98¾	95½	—
4% Second Guar.	99	90	89	—
3% Deb.	85¾	79	77	—
4% Deb.	109¾	104½	101½	—
5% Red.Deb.(1947)	116¼	110½	108½	—
4½% Sinking Fund Red. Deb.	111½	107½	108	—
SOUTHERN				
Pref. Ord.... ...	98¾	82½	87	−1
Def. Ord.	27⅝	20⅛	20	—
5% Pref.	120¾	118½	114	+½
5% Red.Pref.(1964)	119¾	115¼	113½	—
5% Guar. Prefce.	136	129½	124½	+½
5% Red.Guar.Pref. (1957)	120	115¾	114	—
4% Deb.	117 5/16	109½	105½	—
5% Deb.	140	134	126½	—
4% Red. Deb. 1962–67	116½	110	106½	—
BELFAST & C.D.				
Ord.	9	4½	4½	—
FORTH BRIDGE				
4% Deb.	107	105	102½	+1
4% Guar. ...	107 5/16	104	100½	—
G. NORTHERN (IRELAND)				
Ord.	19½	9¾	15	—
G. SOUTHERN (IRELAND)				
Ord.	63	41	27	−5¼
Prefce.	65	46	38½	—
Guar.	97¼	81	73¼	—
Deb.	99¾	83¼	91	—
L.P.T.B.				
4½% "A" ...	127¾	121	113½	—
5% "A" ...	138¼	133½	124½	—
4½% "T.F.A." ...	111½	108½	105	—
5% "B" ...	131¾	123¾	117½	—
"C"	112½	93	79*	—
MERSEY				
Ord.	40¾	23	24½	−1
4% Perp. Deb. ...	103	98	97	—
3% Perp. Deb. ...	78	74⅝	74½	—
3% Perp. Prefce.	68⅞	63¼	66½	—

* ex dividend

CONTRACTS AND TENDERS

Locomotives for Africa

Beyer, Peacock & Co. Ltd. has received an order from the Crown Agents for the Colonies for seven 4-6-2 type passenger locomotives for the Gold Coast Government Railways.

The South African Railways & Harbours Board has placed orders for a total of 45 class 19C. 3-ft. 6-in. gauge 4-8-2 type locomotives divided as follow: Fried. Krupp A.G., 23 locomotives; and Borsig Lokomotiv Werke, G.m.b.H., 22 locomotives.

The Hunslet Engine Co. Ltd. has received an order from the Crown Agents for the Colonies for four locomotive boilers, required for the Sierra Leone Government Railways.

The Economical Boiler Washing Co. Ltd. has received orders from the Great Indian Peninsula Railway for one single-tank double pump locomotive boiler-washing plant for installation at Dhond and one double-tank plant for Jhansi.

The boiler-washing plant which, as announced in our issue of October 15, the Economical Boiler Washing Co. Ltd. is supplying for King's Cross locomotive depot, L.N.E.R., is to replace the existing plant supplied by this firm some 21 years ago and now too small for present-day requirements.

Beyer, Peacock & Co. Ltd. has received an order from the Peruvian Corporation for one locomotive boiler.

The Egyptian Ministry of Communications Committee has recommended the award to Baume & Marpent of the contract for the construction of the Kafr el Zayat bridge over the Nile. The price tendered was £E.233,777, states Reuter.

The Chinese Government Purchasing Commission has placed orders, to the inspection of Messrs. Fox & Mayo, with Summerskill Brothers for one motor-driven planing machine, and with Kitchen & Wade Limited for one Duplex locomotive rod-drilling, tapping, and boring machine. These machines are required for the Chuchow repair shops.

Ransomes & Rapier Limited has received an order from the Bengal-Nagpur Railway Administration for one 75-ft. Mundt type locomotive turntable, required for Khargpur station.

Cowans, Sheldon & Co. Ltd. has received an order from the Bengal-Nagpur Railway Administration for one 75-ft. Vogele type turntable, required for Waltair station.

Cowans, Sheldon & Co. Ltd. is to supply vacuum-operated turning gear for use on both the above-mentioned turntables for the Bengal–Nagpur Railway.

Fredk. Braby & Co. Ltd. has received an order from the Bombay, Baroda & Central India Railway Administration, to the inspection of Messrs. Rendel, Palmer & Tritton, for 200 panel plates.

The Henricot Steel Foundry has received an order for 1,100 cast steel end stanchions for wagons from the Central Argentine Railway.

Beckett, Laycock & Watkinson Limited is supplying Typhoon half-drop windows fitted with Triplex toughened glass in steel pans for a number of trolley inspection railcars which D. Wickham & Co. Ltd. (as already announced in this page) has on order from the South African Railways & Harbours Board.

Locomotive for India

W. G. Bagnall Limited has received an order from the Gondal Railway Administration for one metre-gauge two-cylinder 4-6-0 mixed-traffic locomotive and tender to be supplied to the inspection of Messrs. Robert White & Partners. The engine is designed for a boiler pressure of 180 lb. per sq. in. and 4-ft. dia. coupled wheels.

British Timken Limited has received orders for Timken tapered roller bearing axleboxes, required for 22 electric locomotives, now under construction by Metropolitan Vickers Electrical Co. Ltd., for the South African Railways & Harbours Board. This constitutes a repeat order, and when completed there will be a total of 47 Timken-equipped electric locomotives at work in South Africa.

The Chloride Electrical Storage Co. Ltd. has received an order from the Bombay, Baroda & Central India Railway Administration, to the inspection of Messrs. Rendel, Palmer & Tritton, for 444 lead train-lighting accumulators.

The Quasi Arc Co. Ltd. has received an order from the Chinese Government Purchasing Commission, to the inspection of Messrs. Fox & Mayo, for three portable diesel-engine-driven welding equipments and spares, required for the Tientsin–Pukow Railway.

The Bombay, Baroda & Central India Railway Administration has placed the following orders for machine tools to be supplied to the inspection of Messrs. Rendel, Palmer & Tritton :—

Alfred Herbert Limited; one universal tilting and revolving worktable, one horizontal spindle surface-grinding machine to be manufactured by the Norton Company, one vertical milling machine, and three sensitive drilling machines.

Chas. Wicksteed & Co. (1920) Ltd.; two hacksawing machines.

Butler Machine Tool Co. Ltd.; one shaping machine.

Ormerod Shapers Limited; two shaping machines.

Craven Bros. (Manchester) Ltd.; one horizontal slot drilling and keyseating machine.

Kitchen & Wade Limited; one vertical drilling machine.

Herbert Hunt & Sons Ltd.; one twist-drill sharpening machine.

Churchill-Redman Limited; two lathes.

George Swift & Sons Ltd.; one radial drilling machine.

B. & S. Massey Limited; one portable planing machine.

Atlas Engineering Company; one Duplex bolt-screwing machine and one universal die-sinking machine to be manufactured by the Pratt & Whitney Company.

George Richards & Co. Ltd.; one vertical slot drilling and keyway cutting machine.

Associated Locomotive Equipments Limited has received an order from the Bengal–Nagpur Railway for a quantity of steam and exhaust cams.

D. Wickham & Co. Ltd. has received an order from the South African Railways & Harbours Board for seven pump trolleys.

J. Baker & Bessemer Limited has received an order from the South Indian Railway Administration, to the inspection of Messrs. Robert White & Partners, for 26 steel locomotive tyres.

Mather & Platt Limited has received an order from the Indian Stores Department for 10 train-lighting dynamos and 10 switches.

Volkart Bros. (Engineers) Ltd. has received orders from the Indian Stores Department for 20 train-lighting dynamos, 7,240 steel boiler tubes and 945,000 ft. of electrode.

Forthcoming Meetings

Nov. 3 (*Wed.*).—**Buenos Ayres Western Railway Limited** (Annual General), River Plate House, Finsbury Circus, E.C.2, at noon.

Nov. 10 (*Wed.*).—**Bengal Dooars Railway Co. Ltd.** (Ordinary General), Gresham House, Old Broad Street, E.C.2, at 2.45 p.m.

Forthcoming Events

Oct. 29 (*Fri.*).—Institute of Welding (Manchester), at College of Technology, 7.30 p.m. "Notched Bar Impact Testing."

Nov. 1 (*Mon.*).—Engineers' German Circle, at Inst. of Mechanical Engineers, Storey's Gate, London, S.W.1, 6 p.m. "Ausgewählte Probleme Aus Der Entwicklung Der Magnesiumlegierungen (Elektrometall) (Some Problems in Connection with the Development of Magnesium Alloys)," by Dr.-Ing. W. Schmidt.

Society of Engineers, at Geological Society, Burlington House, Piccadilly, London, W.1, 6 p.m. "Modern Development of Timber," by Mr. E. Kilburn Scott.

Nov. 2 (*Tues.*).—Institute of Transport (Bristol), at the University, 6 p.m. "The Maintenance of Transport in the General Post Office," by Mr. C. Finney.

Inst. of Transport (Metropolitan Graduate), at Inst. of Electrical Engineers, Savoy Place, W.C.2, 6 p.m. "Training of Staff for Public Service Vehicles," by Mr. H. Stevenson.

Institution of Civil Engineers, Great George Street, London, S.W.1, 6 p.m. Presidential Address by Mr. Sydney Bryan Donkin.

Nov. 3 (*Wed.*).—Institution of Civil Engineers (Students), Great George Street, London, S.W.1, 6.15 p.m. "Welding," by Mr. D. Temple.

Nov. 4 (*Thurs.*).—Railway Club, at Royal Scottish Corporation Hall, Fetter Lane, London, E.C.4, 7.30 p.m. "Some Suggested Economies and Passenger Train Services, L.M.S.R.," by Mr. V. Haram.

Southern Railway (London) Lecture and Debating Society, at Chapter House, St. Thomas' Street, S.E.1, 5.45 p.m. "Modern Developments on the German Railways," by Mr. H. Seydel.

Nov. 4-13.—Commercial Motor Transport Exhibition, at Earl's Court, London, S.W.5.

Nov. 5 (*Fri.*).—Institute of Transport (Nottingham Graduate), at Guildhall, 7 p.m. "The Road Traffic Act, 1930, and the Road and Rail Traffic Act, 1933," by Mr. A. Johnston.

Railway Students' Association (Edinburgh), at Goold Hall, St. Andrew Square, 7.30 p.m. "Some Geographical Aspects of Railway Problems," by Mr. J. Phillipps.

LEGAL AND OFFICIAL NOTICES

In the Court of the Railway Rates Tribunal.

Local Government Act, 1929

ELEVENTH SCHEDULE
AND
RAILWAY FREIGHT REBATES ACT, 1936.
1937 REVIEW OF THE OPERATION OF THE RAILWAY FREIGHT REBATES SCHEME
AND
APPLICATION IN RESPECT OF ADMINISTRATIVE EXPENSES.

NOTICE IS HEREBY GIVEN that the Railway Rates Tribunal will sit at 10.30 a.m. on Wednesday, the 17th November, 1937, in Court "A," Judges' Quadrangle, Royal Courts of Justice, London, W.C.2, to review the operation of the Railway Freight Rebates Scheme for the year ending 30th September, 1937, pursuant to the provisions of Part 1 of the Eleventh Schedule to the Local Government Act, 1929, and the Railway Freight Rebates Act, 1936.

NOTICE IS ALSO GIVEN that the Railway Companies to which the said Scheme applies have filed with the Tribunal an Application (1937 No. 597) pursuant to the provisions of sub-paragraph 1(*a*) of paragraph 5 of the said Part 1 of the Eleventh Schedule that in lieu of the sum of one half of one per cent. as directed by Paragraph 5(1)(*a*) of Part 1 of the said Eleventh Schedule there shall be paid out of the Railway Freight Rebates Fund in respect of Administrative Expenses in respect of the period commencing on the 1st day of October, 1937, and ending on the 30th day of September, 1938, a sum equal to one per cent. of the aggregate of the estimated rate relief of the said Companies in respect of that period such sum to be exclusive of any payment out of the said Fund authorised by the Minister of Transport under the provisions of Subsection (3) Section 2 of the Railway Freight Rebates Act, 1936; which Application will also be heard at the above-mentioned time and place.

NOTICE IS FURTHER GIVEN that Accounts and Statements relative to such Review have been lodged with the Tribunal. Such Accounts and Statements and the aforesaid Application may be inspected at the Office of the Registrar, Bush House, Aldwych, London, W.C.2, at any time during office hours. Copies of the said Accounts and Statements may be obtained (price 2s. 6d. post free) on prepayment, from the Secretary, the Railway Clearing House, Euston Square, London, N.W.1.

Any Railway Company to which the said Scheme applies or Representative Body of Traders interested, which may be desirous of being heard before the Tribunal on the Review must file a Notice of such desire and any person desiring to object to the aforesaid Application must file a separate Notice of Objection at the Office of the Registrar, Bush House, Aldwych, London, W.C.2, on or before Tuesday, the 9th day of November, 1937.

Such Notices must be on foolscap size paper and must state concisely the Submission (if any) which is desired to be made, and in the case of an Objection, the nature and grounds thereof. A Notice by a Representative Body of Traders must in addition contain a statement of the facts upon which such Body claims to represent a substantial number of persons interested in any or all of the selected traffics.

Each Notice filed must be stamped with an adhesive fee stamp for 2s. 6d. (which can be purchased at the office of the Tribunal only). If sent by post each Notice must be accompanied by a Postal Order for 2s. 6d. payable to the Registrar, Railway Rates Tribunal, when a stamp will be affixed at the office. Six additional copies of each Notice must be lodged with the original at the office of the Registrar.

Dated this 21st day of October, 1937.

T. J. D. ATKINSON,
Registrar.

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COLONIAL GOVERNMENT APPOINTMENTS.

APPLICATIONS from qualified candidates are invited for the following posts:—

M/5440. CHIEF DRAUGHTSMAN required by the Government of Nigeria for the Mechanical Engineering Department of the Government Railway for two tours each of 12-24 months, with probability of further employment. Salary £400 a year rising to £810 a year. Free passages and quarters and liberal leave on full salary. Candidates, aged 30-35, must be Associate Members of the Institution of Mechanical Engineers or possess an equivalent qualification. They must have served a full apprenticeship with a British Railway or Locomotive Firm and have had subsequent experience in designing or drawing offices; and be capable of setting out the design of a locomotive with approximate weights, a valve gear balancing, and all other detail work connected with locomotive design. Some experience in the design of coaches and wagons is an advantage.

M/5470. ENGINEER required by the Government of Nigeria for the Railway Capital Works for one tour of 12-24 months, with probability of further employment. Salary £720 a year. Free passages and quarters and liberal leave on full salary. Candidates, not over 45, must have a good knowledge of bridge foundations and underpinning, bridge construction with concrete piers and abutments and steel spans, falsework, replacing culverts under traffic, necessitating cutting through railway banks by use of shoring and erecting temporary bridges to carry the track. Preference will be given to candidates who are Corporate Members of the Institution of Civil Engineers.

M/5537. STOREKEEPER required by the Government of Nigeria for the Railway Department for two tours of 12-24 months each, with probability of further employment. Salary £400—£400—£450—£25—£600—£30—£720 a year. Free passages and quarters and liberal leave on full salary. Candidates, aged 27-35, must have had practical experience of railway stores and their classification and be familiar with locomotive spares and their nomenclature.

Apply at once by letter, stating age, whether married or single, and full particulars of qualifications and experience, and mentioning this paper, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W.1, quoting the reference number against the appointment for which application is made.

The New Queen's Hotel, Leeds, L.M.S.R.

To be opened by the Earl of Harewood on Friday, November 12

On Friday, November 12, the Earl of Harewood, who will be accompanied by H.R.H. The Princess Royal, will formally open the L.M.S.R. new Queen's Hotel, Leeds. Four hundred workmen are at present putting the finishing touches to the new hotel, which will be the most modern in the North of England. Taking the place of the existing and old-established Queen's Hotel, the new Queen's Hotel has been planned and built to be worthy of the place which it will fill as an up-to-date centre for the social and industrial life of Yorkshire. The hotel itself forms part of a huge scheme of development costing over £750,000 in all, which is being carried out on the railway property adjoining Leeds City Square, and which involves in addition extensive alterations to the Wellington and New stations, together with the construction of a large office building, with newsreel cinema, adjoining the hotel.

Claimed to be the most completely-equipped hotel in the provinces, the new Queen's will have over 200 bedrooms, all with telephone and private bath, together with extensive dining and banqueting accommodation. The building is of eight storeys, and rises to a maximum height of 115 ft. above street level; the frontage to the City Square is 230 ft. Its catering, heating, lighting and ventilation equipment is of the most modern type, embodying many innovations, while research experts and engineers have collaborated to exclude all extraneous sound from those floors which are near to street level. Some idea of the magnitude of the building, the foundation stone of which was laid last year by the Earl of Derby, is conveyed by the following details of the materials it has required:—2,000,000 bricks, 40,000 cubic ft. of Portland stone; 8,000 yards of concrete in foundations; 3,000 tons of steel; and 30,000 ft. of copper pipes.

L.N.E.R. Accountant's Department Recreative Society's Annual Dinner

Mr. G. Sutherland, Chief Accountant, London & North Eastern Railway and President of the Accountant's Department Recreative Society, presided at the 56th annual dinner, followed by a concert, which was held at the Abercorn Rooms, London, on Friday, October 22. There was an attendance of over 140, and among those present were:—

Sir Ralph Cope, Chief Accountant, G.W.R.; Messrs. G. Morton, Assistant Accountant, L.M.S.R.; C. A. Everard Greene, British Tabulating Machine Co. Ltd.; J. A. Kay, Editor, THE RAILWAY GAZETTE; F. J. Orchin, and A. Feirn, Ministry of Transport. London & North Eastern Officers included Messrs. James McLaren, H. W. H. Richards, H. W. J. Powell, A. P. Ross, J. E. Ryan, L. C. Glenister, G. N. Rhodes, T. Gaynor, W. Philip, H. S. Alsop, J. Inglis, D. Sayer, and R. W. McEwen.

After an excellent dinner all joined heartily in the community singing. The Chairman then announced that as in the previous year there would be no speeches, except that he would briefly propose the toast of "The Visitors." Amongst the visitors, he wished specially to welcome Sir Ralph Cope, who gave distinction to and reflected glory on his colleagues.

Sir Ralph Cope, in responding, said how much he regretted the loss sustained by the L.N.E.R. Accountant's Department by the death of Mr. R. Brown, Assistant Accountant.

A musical and variety programme, arranged under the direction of Mr. Bernard Barker, followed, and the various turns were very much appreciated.

Railway Share Market

The volume of business in all sections of the Stock Exchange has been very small and the tendency was for sentiment to move in accordance with the day-to-day fluctuations of Wall Street markets. Towards the middle of the week a better undertone appeared to be developing, and Home railway junior stocks were inclined to attract more attention, although only fractional improvements in prices were made. The market again professed to be somewhat disappointed with the traffic figures, despite the larger aggregate gain of £166,000 for the past week. The belief is now widely held that a fair amount of traffic which would normally have been carried this month was sent towards the end of September in order to escape the higher charges. Consequently, there are hopes that during the next few weeks the returns may show larger increases.

L.M.S.R. ordinary was more active around 31 on satisfaction with the £71,000 traffic increase for the past week. The 4 per cent. preference at 83 and 4 per cent. 1923 preference at 74 continue to be viewed as undervalued having regard to the increasing cover for their dividends, but in the existing trend of markets it is perhaps hardly surprising that little demand for the stocks was reported. Great Western ordinary was in better request at 63, the traffic increase of £29,000 for the past week being regarded as good. Southern preferred at 87 and the deferred at 20¼ were out of favour following publication of the traffic figures, the gain in this case being only £5,000. L.N.E.R. second preference and first preference at 27¼ and 70½ respectively were steady features, satisfaction being expressed with the trend in the traffics. The latter show a rise of £61,000 for the past week. Guaranteed and debenture stocks were firm. London Transport "C" remained steady prior to publication of the report and accounts.

Argentine railway stocks were inactive, awaiting a change in surrounding market conditions and the statements at the meetings of the railways, which are being awaited with more than usual interest. B.A. Gt. Southern ordinary and preference were, however, unresponsive to the rather cautious remarks at the meeting on Wednesday and B.A. Pacific and B.A. Western issues failed to benefit from the not unsatisfactory impression created by the reports and accounts. Cordoba Central debentures reacted and Entre Rios 4 per cent. debentures were unresponsive to the payment on account of arrears of interest. San Paulo ordinary was subject to liquidation. American rails are lower and Canadian Pacifics have also given way.

Traffic Table of Overseas and Foreign Railways Publishing Weekly Returns

	Railways	Miles open 1936-37	Week Ending	Traffics for Week: Total this year	Traffics for Week: Inc. or Dec. compared with 1936	No. of Weeks	Aggregate Traffics to Date: Totals: This Year	Aggregate Traffics to Date: Totals: Last Year	Aggregate Traffics to Date: Increase or Decrease	Shares or Stock	Prices: Highest 1936	Prices: Lowest 1936	Prices: Oct. 27, 1937	Prices: Yield % (See Note)
South & Central America	Antofagasta (Chili) & Bolivia	834	24.10.37	£ 18,320	+ £ 2,050	43	£ 705,640	£ 587,430	+ £ 118,210	Ord. Stk.	25	15¼	16½	Nil
	Argentine North Eastern	753	23.10.37	10,161	+ 461	17	176,509	158,650	+ 17,859	,,	12	2	8½	Nil
	Argentine Transandine	—	—	—	—	—	—	—	—	A. Deb.	54	45	85	4 11/16
	Bolivar	174	Sept., 1937	3,750	− 1,450	15	49,350	57,700	− 8,350	6 p.c. Deb.	9	5	8½	Nil
	Brazil	—	—	—	—	—	—	—	—	Bonds.	16	11½	14½	3 7/16
	Buenos Ayres & Pacific	2,806	23.10.37	92,630	+ 3,159	17	1,333,624	1,258,340	+ 75,284	Ord. Stk.	17½	6	8½	Nil
	Buenos Ayres Central	190	10.10.37	$145 800	− $31,800	15	$2,155,300	$1,982,600	+ $172,700	Mt. Deb.	31½	11	28	Nil
	Buenos Ayres Gt. Southern	5,084	23.10.37	135,670	+ 15,845	17	2,025,186	1,849,196	+ 175,990	Ord. Stk.	31¾	13¾	20	Nil
	Buenos Ayres Western	1,930	23.10.37	47,208	+ 2,737	17	770,162	666,937	+ 103,225	,,	29¾	11	17	Nil
	Central Argentine	3,700	23.10.37	122,882	− 17,043	17	2,092,025	2,321,897	− 112,872	,,	32 9/32	8¾	17	Nil
	Do.	—	—	—	—	—	—	—	—	Dfd.	21	4½	9½	Nil
	Cent. Uruguay of M. Video	980	16.10.37	16,078	− 160	16	240,710	238,281	+ 2,429	Ord. Stk.	7¾	3	5	Nil
	Cordoba Central	1,218	23.10.37	19,910	− 5,740	17	567,080	562,320	+ 4,760	Ord. Inc.	5	1	3½	Nil
	Costa Rica	188	Aug., 1937	24,617	+ 7,487	9	49,305	38,568	+ 10,737	Stk.	36½	32	34	5 7/8
	Dorada	70	Sept., 1937	17,200	+ 2,800	39	139,600	126,600	+ 13,000	1 Mt. Db.	107	101½	104½	5 3/4
	Entre Rios	810	23.10.37	13,784	+ 243	17	236 685	211,637	+ 25.048	Ord. Stk.	17	6	10	Nil
	Great Western of Brazil	1,092	23.10.37	11,400	+ 1,200	43	318,200	320,400	− 2,200	Ord. Sh.	1/2	3/16	3/8	Nil
	International of Cl. Amer.	794	Aug., 1937	$412,515	+ $95,199	35	$4,038,361	$3,624,520	+ $413,841	—	—	—	—	—
	Interoceanic of Mexico	—	—	—	—	—	—	—	—	1st Pref.	1/2	-/6	1/2	Nil
	La Guaira & Caracas	22¾	Sept., 1937	4,465	+ 115	39	47,665	41,545	+ 6,120	Stk.	9	3	7½	Nil
	Leopoldina	1,918	23.10.37	21,895	− 1,973	43	997.673	882,863	+ 174,810	Ord. Stk.	10½	3½	5	Nil
	Mexican	483	21.10.37	$252,600	− $19,300	16	$4,827.700	$4,184,700	+ $643,000	,,	1¼	1/4	1/2	Nil
	Midland of Uruguay	319	Sept., 1937	8,988	+ 1,282	13	23,566	23,460	+ 106	,,	1½	1/8	1/2	Nil
	Nitrate	384	15.10.37	4,231	+ 46	41	122,245	97,785	+ 24,460	Ord. Sh.	63/6	41/9	21/8	Nil
	Paraguay Central	274	16.10.37	$2,629,000	+ $314,000	16	$51,064,000	$41,684,000	+ $9,380,000	Pr. Li. Stk.	85	71	81½	7 5/8
	Peruvian Corporation	1,059	Sept., 1937	89,953	+ 4,468	13	263,674	257,046	+ 6,628	Pref.	15	9	7	Nil
	Salvador	100	16.10.37	¢13,375	− ¢625	16	¢191 534	¢170,730	+ ¢19,804	Pr. Li. Db.	18	16	22½	Nil
	San Paulo	153½	17.10.37	28,096	+ 6,253	41	1,386,691	1,231,795	+ 154,806	Ord. Stk.	86	46½	74½	6 11/16
	Taltal	160	Sept., 1937	2,575	− 30	13	10,070	8,755	+ 1,315	Ord. Sh.	115 32	14/-	9/8	11 5/8
	United of Havana	1,353	23.10.37	14,373	− 358	17	286,415	260,200	+ 26,215	Ord. Stk.	3¼	1	2	Nil
	Uruguay Northern	73	Sept., 1937	812	− 97	13	2,372	2,601	− 229	Deb. Stk.	5	3	6	Nil
Canada	Canadian National	23,767	21.10.37	904,435	+ 40,632	42	31,783,893	29,371,348	+ 2,412,545	—	—	—	—	—
	Canadian Northern	—	—	—	—	—	—	—	—4 p.c.	Perp. Dbs.	76	51	66½	6
	Grand Trunk	—	—	—	—	—	—	—	—	4 p.c. Gar.	104 5/4	99¾	100½	4
	Canadian Pacific	17,228	21.10.37	659,200	+ 18,200	42	23,006,000	21,908,000	+ 1,098,000	Ord. Stk.	16 5/4	101 15/16	81½	Nil
India†	Assam Bengal	1,329	10.10.37	43,012	+ 5,835	27	699,626	650,255	+ 49,371	Ord. Stk.	87 5/4	82 1/4	77 1/2	3 7/8
	Barsi Light	202	30.9.37	2,767	+ 645	26	65.377	60,150	+ 5,227	Ord. Sh.	77 1/2	65 1/2	47	10 5/8
	Bengal & North Western	2,111	10.10.37	57,782	− 9,525	2	57.782	67,307	− 9,525	Ord. Stk.	319	292 5/8	308	5 15/16
	Bengal Dooars & Extension	161	10.10.37	4,852	+ 563	27	76,301	68,396	+ 7,905	,,	127 1/2	118	85 1/2§	7
	Bengal-Nagpur	3,268	10.10.37	197,025	+ 32,712	27	3,622,279	3,153,813	+ 468,466	,,	104	100 1/4	90 1/2	4 7/16
	Bombay, Baroda & Cl. India	3,072	20.10.37	228,600	+ 19,650	28	4.802,700	4,467,600	+ 335,100	,,	114	110 1/2	111 1/2	5 3/8
	Madras & Southern Mahratta	3,229	30.9.37	137,025	+ 5,803	26	2,773,102	2,732,963	+ 40,139	,,	116 1/2	108 1/2	108 1/2	7 3/8
	Rohilkund & Kumaon	546	10.10.37	11,281	− 442	2	11,281	11,723	− 442	,,	311	286	310	5 13/16
	South Indian	2,531¾	30.9.37	125,658	+ 12,304	26	2,107,649	2,026,788	+ 80,861	,,	107 1/2	102 5/16	101 1/2	5 7/16
Various	Beira-Umtali	204	Aug., 1937	103,370	+ 29,470	48	877,668	719,218	+ 158,450	—	—	—	—	—
	Egyptian Delta	620	10.10.37	8,952	− 143	27	128,692	119,568	+ 9,124	Prf. Sh.	21 1/4	15 3	1	Nil
	Great Southern of Spain	—	—	—	—	—	—	—	—	Inc. Deb.	11 2	1 8	3 1/2	Nil
	Kenya & Uganda	1,625	Sept., 1937	191,212	+ 26,474	39	2,114,111	1,948,133	+ 165,978	—	—	—	—	—
	Manila	—	—	—	—	—	—	—	—	B. Deb.	50 1/2	37	44 1/2	7 7/8
	Midland of W. Australia	277	Aug., 1937	12,678	+ 1,026	9	22,923	21,865	+ 1,058	Inc. Deb.	97	93 1/2	95	4 3/16
	Nigerian	1,900	11.9.37	46,171	+ 10,272	24	1,133,403	688,642	+ 444,761	—	—	—	—	—
	Rhodesia	2,451	Aug., 1937	438,628	+ 118,591	48	4,203,086	3,207,556	+ 995,530	—	—	—	—	—
	South Africa	13,263	16.10.37	695,332	+ 59,418	29	18,247,533	17,137 179	+ 1,110,354	—	—	—	—	—
	Victoria	4,774	May, 1937	822,932	+ 43,220	48	9,342,068	8,986,232	+ 355,836	—	—	—	—	—
	Zafra & Huelva	112	Aug., 1937	11,812	+ 10,374	35	101,758	59,281	+ 42,477	—	—	—	—	—

NOTE.—Yields are based on the approximate current prices and are within a fraction of 1/16.

† Receipts are calculated @ 1s. 6d. to the rupee. § ex dividend. Salvador and Paraguay Central receipts are in currency.

The variation in Sterling value of the Argentine paper peso has lately been so great that the method of converting the Sterling weekly receipts at the par rate of exchange has proved misleading, the amount being overestimated. The statements are based on the current rates of exchange and not on the par value.

Diesel Railway Traction

The German Flyers

VARIOUS press reports that the German streamlined diesel trains are to be withdrawn on the routes between the German capital and Hamburg, Cologne, Munich, and Stuttgart, have not given much detail as to the reasons which precipitated this step. As far as can be learned, this withdrawal is temporary and is due to several reasons, about half of which are political and not anything to do with railway operation. The exact date of the withdrawal was governed to some extent by a number of trains being due for heavy overhaul at the same time, and a continuance of the diesel services would have meant that no spare cars would have been available for any of the services, as none of the ten or a dozen trains now on order is quite complete. But it has been increasingly evident during the last few months that the particular urgency for the use of national fuel in Germany, coupled with the endeavours made to get as much foreign money and as few foreign imports as possible into the country, would ultimately lead to a reduction in the widespread diesel services, although it might have been expected that less important trains worked by the smaller of the 300-odd diesel cars would have been superseded first. Intensive experiments have been made in recent months with oil produced in Germany from lignite tar, but up to the present only engines of 150 b.h.p. have used this fuel. As regards the Munich and Stuttgart services, a contributory cause is the forthcoming opening of electric traction over the line from Nuremberg to Leipzig, and this would in any case have caused the withdrawal of those diesel services. The three-car trains operating on the Berlin—Breslau—Beuthen service and the Fliegende Frankfürter, and presumably, the Cologne—Hamburg train, are still in normal service. The steam trains which have replaced the diesels are 51 min. slower on the Munich service, 47 min. slower on the Cologne service, and 10 min. slower on the Hamburg route, where the huge streamlined steam locomotives already operate on schedules up to 74½ m.p.h. The departure times are the same as before in each case, giving, in effect, a shorter time for business in Berlin and a later time of arrival at the home station at night.

The Mileage of Streamliners

THERE is a tendency in some quarters to regard the mileages regularly attained by diesel streamliners with an incredulity similar to that of the rustic who saw a giraffe for the first time. Nevertheless, these performances are quite authentic, and if the maintenance and operating charges of some of the trains, taking into account all the depots concerned, are somewhat high, that is only to be expected with high-power equipment on quite new principles and working over, in some cases, a 2,000-mile route. A good steam locomotive in this country may cover 80,000 to 85,000 miles in 10 to 12 months and some of the steam streamliners more than this, after which comes a general overhaul. On various lines abroad where long runs can be made, mileages of express locomotives rise to 15,000 miles a month, and perhaps 100,000 or so in a year, although the average of express engines as a whole is considerably lower. But the intensive use to which diesel trains can be put results in mileages at least 50 per cent. greater even with short end-to-end runs, and to 100 per cent. or more under optimum conditions. For example, the *Comet* diesel-electric train of the New York, New Haven & Hartford Railroad, put into traffic in June, 1935, has averaged 140,000 miles a year, including the time spent in the single major overhaul which has so far been necessary, despite the fact that it operates on a shuttle service over a route only 44 miles long. The fourteen 820 b.h.p. twin-car Flying Hamburger sets of the German State Railway in 1936 covered 1,250,000 miles, this figure including any units under repair or held in reserve; the monthly mileage of certain sets varied from 19,000 to 22,500. In this case it is the reserve sets rather than repairs which up to the present have limited the average mileage per unit taken over the whole stud to a purely nominal figure, for with the widespread area to be worked over by comparatively few rakes, the number of sets held in reserve is proportionately high. The *Lyntog* trains in Denmark, operating in a much more concentrated area, have averaged 130,000 miles a year, according to Mr. Knutzen, the General Manager of the Danish State Railways. In America, where few sets are held in reserve, and maintenance methods are of an intensive character, mileages are much greater. The Twin Zephyr service calls for a mileage per train of 26,500 a month, and the availability over a period of two and a half years has been about 97 per cent. From April 21, 1935, to December, 1936, the two three-car Zephyrs on this service covered 1,213,357 miles, an actual yearly average of 350,000 miles a train, and were then replaced by seven-car trains and transferred to other routes. The *Flying Yankee* travelling over a 250-mile route covered 418,000 miles in two years before going for a general overhaul. The two 12-car *City of Denver* trains of the Union Pacific covered an aggregate of 765,000 miles in the first year of their service, and the cross-continent trains from Chicago to Los Angeles average 25,000 miles a month throughout the year. It is worth noting that most of these mileages began when the trains were first put into service, and that increasing experience and improved maintenance methods are enabling the rostered mileage to be achieved more nearly and with less trouble, although with availabilities of over 95 per cent. there is a limit to the improvements which are still possible. Nevertheless, there is still a great field in which maintenance costs might be reduced, and this is being tackled by all the railways owning high-speed rakes, both in the fields of shed maintenance and heavy repairs. One of the most potent factors in effecting any such reduction is to use an engine of ample power.

EXHAUST GAS CONDITIONING

A new system of cooling and cleaning for application to oil engines

THE composition of diesel exhaust gas and its importance and treatment in underground work was dealt with at some length in our issue of August 6, and it will be remembered that the mine locomotives described on that occasion had the simplest possible exhaust cooling arrangements. The carbon monoxide content was shown to rise in certain circumstances to 0·5 per cent. although generally under 0·1 per cent. with locomotives in good condition; the carbon dioxide content ranges from 10 per cent. at full load to 2·5 per cent. at idling, and the oxygen content from 7·5 per cent. at full load to 17·5 per cent. at no load. The characteristic diesel smell is due to aldehydes and although not dangerous generally, these can cause discomfort to the eyes and nose in a confined space.

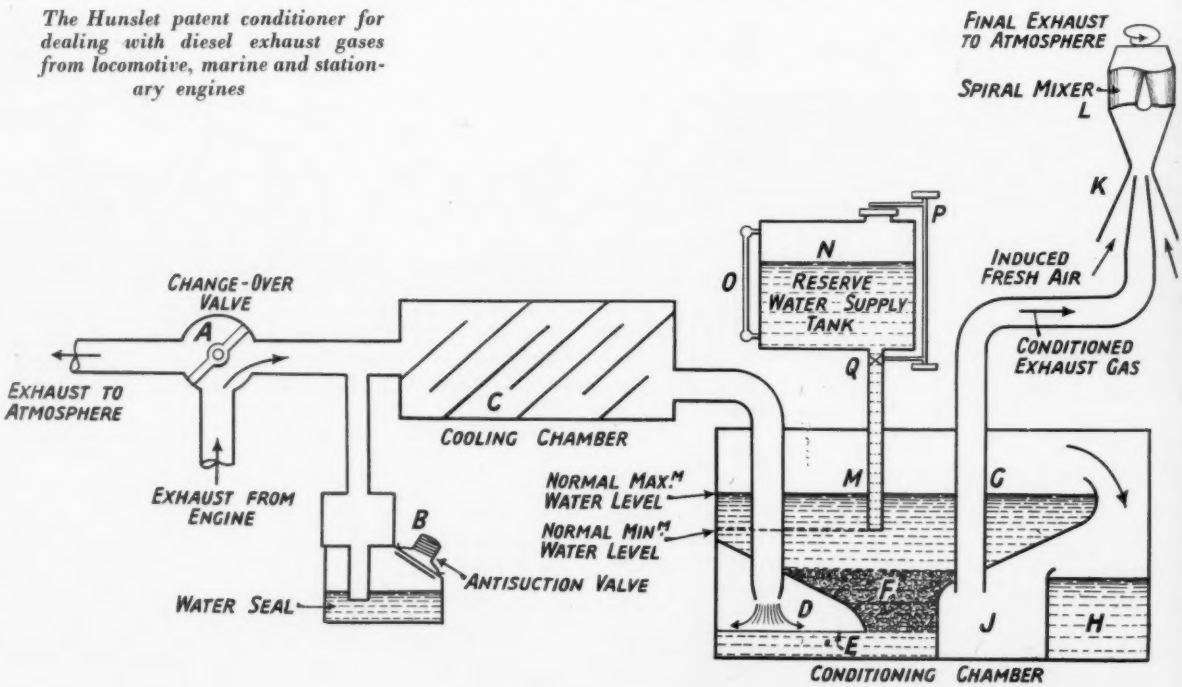
The problem of thoroughly cooling and conditioning the exhaust gases of diesel engines of all types working underground, in warehouses, explosive factories and the like, has been tackled in a comprehensive manner by the Technical Director of the Hunslet Engine Co. Ltd., Mr. John F. Alcock, whose work in connection with the perfection of diesel shunting locomotives is well known, and as a result, the Hunslet conditioner, as described below, has been patented.

The problem of exhaust gas conditioning resolves itself mainly, but not entirely, into the washing out of the aldehydes and the safe care of hot carbon sparks. Several types of washers and scrubbers have been used for this purpose but without exception they all suffer from the same trouble. Owing to the heat contained in the exhaust, many types of washers which have been tried are completely dry in little over an hour, and unless filled with fresh water immediately are quite useless; if an absorbent material which when dry is inflammable, is used to hold the water, there is even a possible danger of fire inside the conditioner itself. The important thing is to conserve the water supply as far as possible, and finally, in the event of neglect, to ensure that even if the conditioner becomes inoperative as far as exhaust washing is concerned it will not become inoperative as regards the fire danger.

The Hunslet conditioner, shown on the accompanying diagram, is designed to achieve this ideal. The change-over valve *A* is fitted in those cases where the locomotive on occasion travels outside the dangerous area, and the driver can then switch over to cut out the conditioner and thus save water wastage. This valve is never fitted where the fire danger is acute, thus preventing the driver from accidentally omitting to change over when entering the dangerous area.

It is possible for a diesel engine to run in the reverse direction, or even to be driven in the reverse direction through the transmission, and in such cases air will be drawn into the cylinders through the exhaust manifold. If the design of the conditioner either through overfilling or any other reason permitted water to be drawn back into the engine a serious engine failure would take place, and to obviate this some form of valve to break the suction is required. The arrangement shown at *B* forms an effective water seal when the engine is operating correctly and prevents any possibility of exhaust gas or sparks reaching the atmosphere, but at the same time easily draws air when and if required. A cooling chamber *C* is incorporated in order to reduce the temperature of the exhaust gases and thus save as much evaporation of the conditioning water as possible. This chamber is pro-

The Hunslet patent conditioner for dealing with diesel exhaust gases from locomotive, marine and stationary engines



vided with internal baffles inside and cooling fins on the outside, and in order to dissipate as much heat as possible is placed in the air stream.

The gases then reach the conditioning chamber proper. They impinge with some force upon the lower water surface at *D* and all sparks are immediately quenched; the gas then bubbles under the separation plate at *E* and passes through materials at *F* which ensure a thorough scrubbing action and the removal of the aldehydes. The gas then bubbles up into the chamber *G* and is made to sweep over the corner baffle in such a way as to strike the surface of the auxiliary safety reservoir *H*. This reservoir is a final trap for any particles which may be in suspension in the gases, but is mainly useful when the water level has accidentally dropped below the normal minimum level. Passing into the chamber *J* the gases leave the conditioner and are finally mixed with fresh air in a venturi swirl chamber at *K* and *L*. With this conditioner the water is evaporated quite slowly, but some evaporation does take place, and the make-up is automatically supplied from the reserve tank *N* by the filler pipe *M*. The reserve tank carries an interconnected link mechanism, *P*, so that the filler cap can only be removed when the stop-cock *Q* is closed. A sight gauge *O* is arranged in order to try and provide against the possibility of running short of water, but further provision is also made against this contingency.

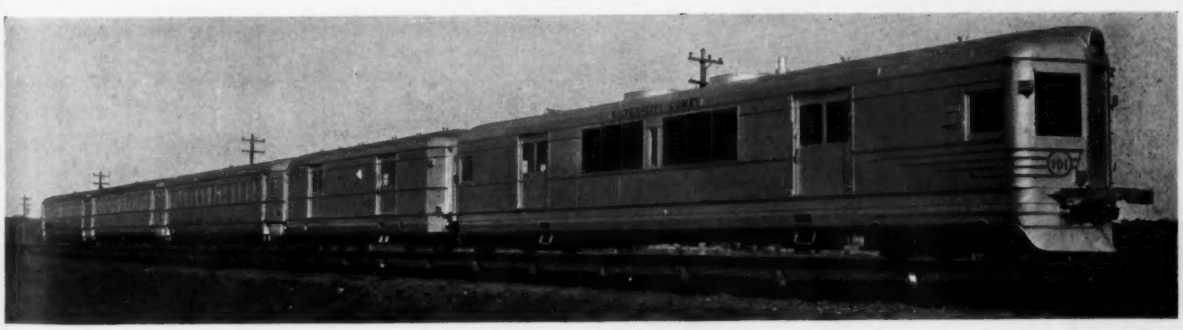
It has been fully proved by experiment that although water quickly evaporates when exhaust gases are actually passed through it, the evaporation is very slow when the gases merely impinge upon the surface of the water. Assuming that through negligence the locomotive continues in service long after a fresh water supply should have been made, and that finally the water level is reduced down to that normally existing in chamber *D*, the materials at *F* will be dried out and consequently must be of a non-inflammable type. Although the thorough scrubbing and washing action has been lost, the surface impact and quenching action due to the nozzle at *D* and the remaining water surface still takes place. If in passing through the dry material at *F* the gases pick up any small particles of carbon previously left there these will be adequately dealt with by the surface impact due to centrifugal force on the water surface at *H*. Furthermore, evaporation at this stage will have almost ceased and the water levels at *D* and *H* will remain fully effective over a long period. For the most dangerous conditions, an explosion-proof grille similar to that on the inlet is attached to the outlet from the conditioner.

It is appreciated that where safety in coal mines is concerned all auxiliary equipment must be protected in addition to treating the engine inlet and exhaust in the manner described. Electrical equipment is all totally enclosed, and friction materials are used for the brake blocks and also to cover the buffer heads. As a final precaution against the most dangerous conditions, the complete locomotive is totally enclosed and supplied with air only through a battery of unit flame-proof grilles, so that even in the event of a complete engine break-up through piston seizure or similar cause there could be no possibility of flame or hot details reaching the atmosphere in any way.

The Hunslet system of conditioning has been applied to all sizes of diesel locomotives from 20 b.h.p. up to a 200 b.h.p. built at the Jack Lane works. The 200 b.h.p. size, with a Gardner engine is believed to be the largest ever built in the world for underground work. The equipment also has been supplied to other manufacturers for use on diesel engines other than those installed in locomotives.

DIESEL TRAINS FOR AUSTRALIA

An extensive use of aluminium alloys has been made on these trains, the first of which has gone into service over the 422-mile branch from Parkes to Broken Hill on the New South Wales Government Railways



Over 1,400 miles of dusty country this 660 b.h.p. train averaged 51 m.p.h. including stops on a trial trip from Sydney to Broken Hill and back

THE four diesel-hydraulic trains for the standard-gauge lines of the New South Wales Government Railways have been completed, and, as intimated in the October 1 issue of this Supplement, the first is known as the Silver City Comet, and from September has been operating an accelerated tri-weekly service between Parkes and Broken Hill. Another service will be over the similar type of line from Dubbo to Bourke, and the platforms at Parkes and Dubbo have been lengthened by 300 ft. and covered with awnings to allow passengers to change easily and comfortably to and from the connecting steam trains. These four trains each comprise five vehicles, although on certain occasions the parcels van is omitted from the rake. The leading car houses the power, transmission and auxiliary equipment, and carries also a certain amount of baggage; the second vehicle is devoted wholly to the

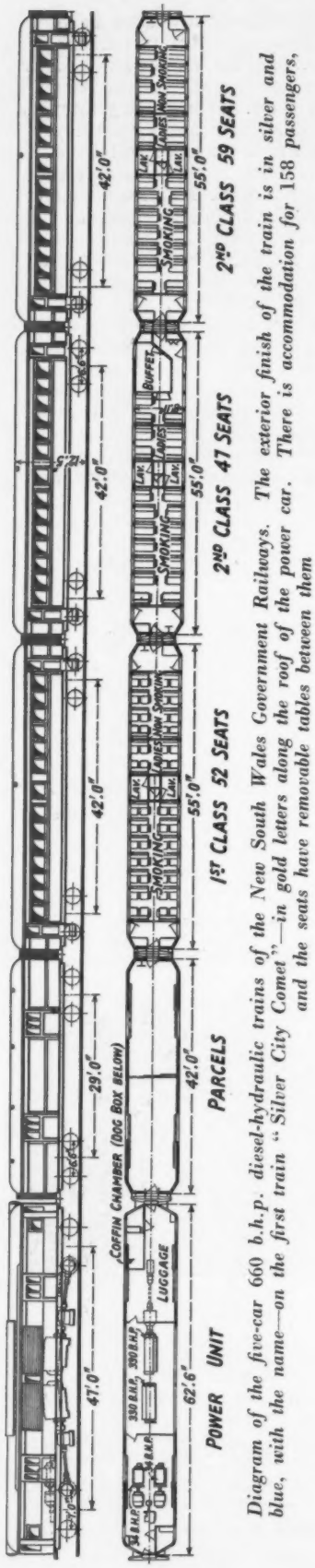
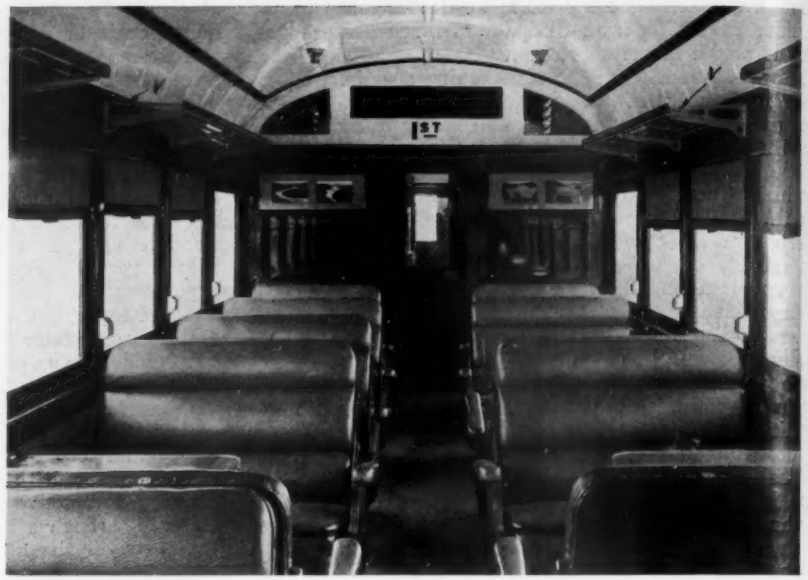


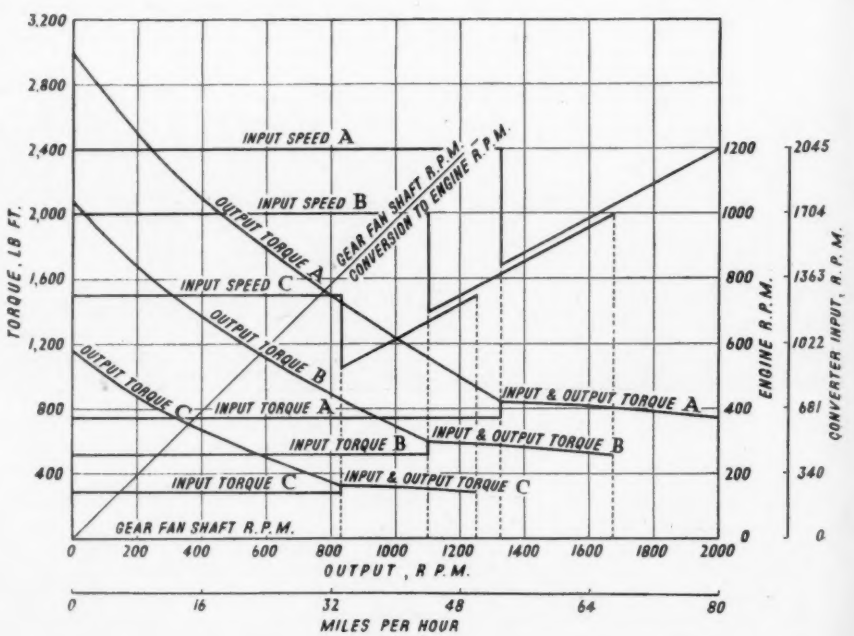
Diagram of the five-car 660 b.h.p. diesel-hydraulic trains of the New South Wales Government Railways. The exterior finish of the train is in silver and blue, with the name—on the first train "Silver City Comet"—in gold letters along the roof of the power car. There is accommodation for 158 passengers, and the seats have removable tables between them



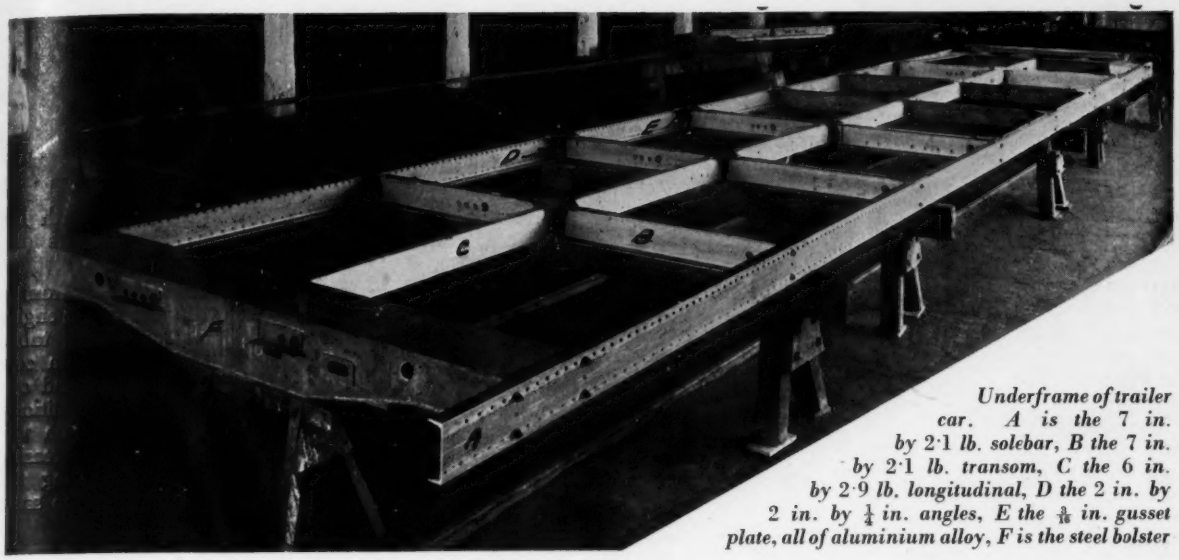
Interior of first-class saloon

carriage of parcels. Both these cars were built in the railway shops at Redfern, and the complete train is to the designs and requirements of Mr. H. Young, the Chief Mechanical Engineer. The three passenger trailers of each train, 12 vehicles in all, were built by Ritchie Brothers, and are fabricated largely of aluminium supplied by the Aluminium Union Limited. The power equipment of each train consists of two 330 b.h.p. Harland & Wolff two-stroke engines (Burmeister & Wain system) which drive through Voith-Sinclair hydraulic transmission. The order for the ten engines and hydraulic transmission sets was booked in 1934 by A.E.C. (Australia) Proprietary Limited at a price of £34,507.

In the centre of the power car are located end-to-end the two eight-cylinder Harlandic oil engines, each with a continuous rating of 330 b.h.p. at 1,200 r.p.m. and a short-time output of 360 b.h.p. They were illustrated and described in the issue of this Supplement for January 22 last. The cooling system includes



Characteristic curves of Voith-Sinclair turbo-converter



Underframe of trailer car. A is the 7 in. by 2·1 lb. solebar, B the 7 in. by 2·1 lb. transom, C the 6 in. by 2·9 lb. longitudinal, D the 2 in. by 2 in. by ¼ in. angles, E the ⅜ in. gusset plate, all of aluminium alloy, F is the steel bolster

radiators arranged on the power car sides and two fans in the roof. The engines are started by air and the fuel supply is controlled on the Exactor system. (See issue of this Supplement for April 16, 1937.) The Voith-Sinclair turbo-converters are driven through step-up gearing, giving a normal full-load speed of 2,045 r.p.m., at which the converter is designed to transmit 290 b.h.p. continuously; the performance curves of the converter are given in one of the accompanying diagrams. The final drives are combined with the reverse gears on the inner axle of each bogie, and the complete transmission is arranged to give a top speed of 80 m.p.h. Power for the auxiliary services, air-filtering, lighting, buffet equipment, and brake compressor is supplied by two 34 b.h.p. National oil engines. The main fuel tanks are beneath the floor and have a maximum capacity of 600 gal. In order to keep the prevalent dust away from the engines and auxiliary equipment, a slight air pressure is built up in the engine room by means of a fan. The power car is of steel and the bogies have cast steel frames fitted with S.K.F. roller bearing axleboxes. Rubber is used extensively in the bogie and spring system to damp out noise and vibration. Westinghouse brakes are used in conjunction with a retardation controller and with the incorporation of dead-man control; air from the brake supply is used for the sanding gear and for the horn.

Parcels and Trailer Cars

The parcels car has a connecting vestibule at each end and is fitted with shelves for light parcels; the carrying capacity for light goods and parcels is 10 tons on a tare weight of 15 tons. The body sides, underframe solebars and roof frame members are of steel, welded together to form a box girder structure. Aluminium alloy rolled sections are used for the underframe transoms and centre longitudinals and the floor plate is of ⅛-in. aluminium alloy sheet. The floor and side panels are lined inside with tongued and grooved coach wood and the ceiling is of plywood; the space between the ceiling and the roof is insulated with cow-hair felt. Cast aluminium alloy sliding doors are fitted on each side.

One first class and two second class cars complete the rake. The first class unit tares 22·4 tons, the leading second class car, containing the buffet, 24·5 tons, and the trailing second class car 22·3 tons. The framework of all these cars is generally the same; the longitudinal side frame girders are built up to the window level and are of 17 ST aluminium alloy plate, with a 3½-in. by ½-in. steel bar as a top compression flange, and a 7-in. channel, a 2-in. by ¼-in. and a 3½-in. by ½-in. bar, all of 17 ST aluminium alloy, formed into a bottom flange. These side girders are connected to welded steel framework forming the headstock and bolsters. The main underframe members, with the exception of the end bolsters, are generally of 17 ST aluminium alloy sections with 51 ST alloy cleats and gussets, arranged as shown in the illustration at the head of this page.

External body panels of 3 SI/2H aluminium alloy are used in two divisions between floor and cantrail and in three lengths longitudinally, the joints being covered by aluminium strip. There are timber body pillars behind the panels, and they are reinforced with steel and bolted to the side girders. The car ends, and the side and end doors also are of aluminium. At the floor level the car sides are extended downwards in the form of a ⅛-in. apron of aluminium alloy which is further secured to the main longitudinal girders by aluminium carrier angles. The roof is of timber, covered with flax canvas, and the timber floor laid over the aluminium floor plate is quite separate from the timber side framing. A double layer of felt is laid between the timber and aluminium floors. The structural aluminium alloy in the underframe is painted with a base coat of red lead, then with two coats of grey paint, and finally with two coats of Alpaste aluminium paint, a product of the Aluminium Union Limited. An average of 3,100 lb. of aluminium alloy is used in each trailer car, this including the numerous brackets and fittings, such as seat frames and baggage racks, in the interiors of the saloons, most of these details being of anodised aluminium. The walls are insulated against temperature variation, the sealed windows are of double glass, and the air is conditioned on the Carrier system. It is filtered and forced into the cars, and in hot weather also cooled and dried. In cold weather, when the air is warmed, no humidity control is considered necessary in view of the comparatively mild climate.

NEW FRENCH RAILCARS.—Three new double-engined De Dietrich railcars of 320 b.h.p. have been put into traffic in the Rennes district by the French State Railways. Powered by two 160 b.h.p. Saurer engines, they differ from earlier vehicles of the same general type in that they have both first and second class accommodation and have streamlined end contours.

RAILCAR OIL ENGINES

The fourth instalment of an article summarising the engines used for railcar work covers European countries other than France and Germany

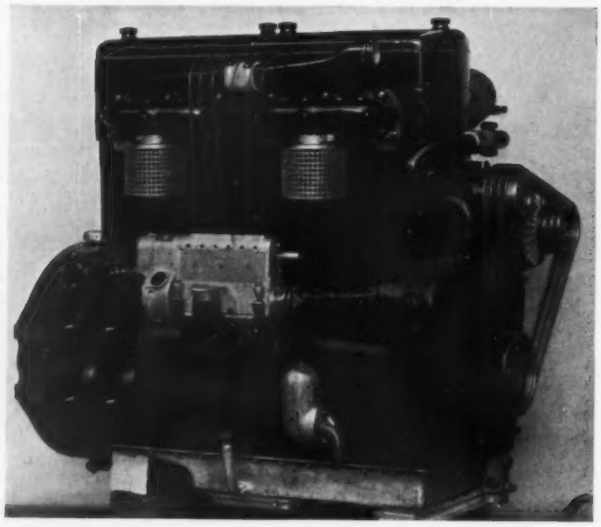
A GREAT number of the railcar oil engines built in central, southern, and eastern Europe are for the home market, but certain companies, such as Ganz, also have a large export trade, and in the case of the two Swiss makers, Saurer and Sulzer, the engines are almost wholly for export. Both of these Swiss companies have works in France where many engines are built for the French railways.

Saurer

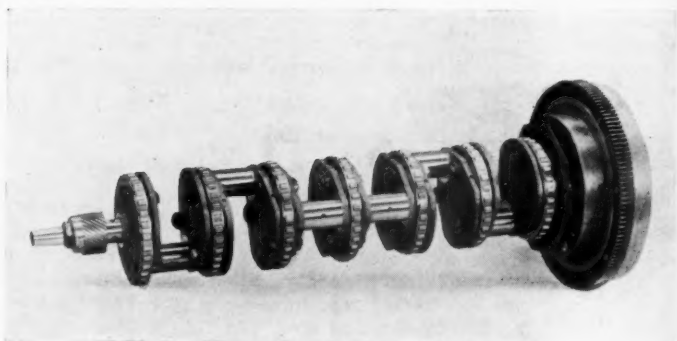
The Saurer works at Arbon and the associated French factory at Suresnes have been concerned in the railway field almost exclusively with the production of engines for railcar work, as has the Off. Mech. Brescia, the Italian licensee. On the other hand, Armstrong-Whitworth has built the same types of engine for both railcars and locomotives.

The Saurer range installed in railcars varies from a four-cylinder model of 75 b.h.p. to a 12-cylinder vee engine of 300 b.h.p., as indicated in the accompanying table. The power output figures given are the maximum continuous railway ratings, but in service will be found certain vehicles which, to suit particular traffic conditions, have somewhat lower ratings. The BXD engine was developed in 1935-36 into the BXDS type by increasing the cylinder diameter slightly, and thus enabling the rating to be raised from 150 to 160 b.h.p. at the same speed of 1,500 r.p.m.

In the six-cylinder types the cylinder block and crankcase are cast integrally of cast iron, and have cast iron liners inserted; the heads are cast in blocks of three, and each head contains two inlet and two exhaust valves. This quadruple valve arrangement was adopted in 1934 in conjunction with a changeover from the old Acro head to the then new form of Saurer dual-turbulence, which incorporates a double-spherical cavity in the piston crown, and brought about a reduction in the fuel consumption at full-load full-speed of about 12 per cent. to 0·38 lb. per b.h.p.hr. and an increase of 7 per cent. in the normal output. The built-up nickel-chrome steel crankshafts of all the Saurer engines are of an unusual design, the main bearings being of the roller type encircling the crank webs, which thus form large diameter journals and give an exceptionally rigid shaft; this type of construction has given most successful performance. The connecting rods have big-end bearings of lead-bronze run directly on to the nickel-chrome steel of the rod. The pistons are of special aluminium alloy and carry four compression and two scraper rings. Bosch or Scintilla fuel pumps are fitted as desired, but the fuel injection valves in the



Above: Saurer six-cylinder engine with a continuous rating of 150 b.h.p. at 1,500 r.p.m. The special Saurer double-turbulence combustion chamber is incorporated



Right: Crankshaft for Saurer six-cylinder engine. The roller bearings encircle the crank webs

CHARACTERISTICS OF SAURER RAILCAR ENGINES

Type	BOD	BLD	BUD	BXD	BXDS	BZD
Number of cylinders	4	6	6	6	6	12
Bore and stroke, mm.	110×150	110×150	120×170	130×180	134×180	130×180
B.h.p.	75	95	125	150	160	300
R.p.m.	1,800	1,800	1,600	1,500	1,500	1,500
Weight, lb.	1,340	1,800	2,325	2,600	2,700	4,900

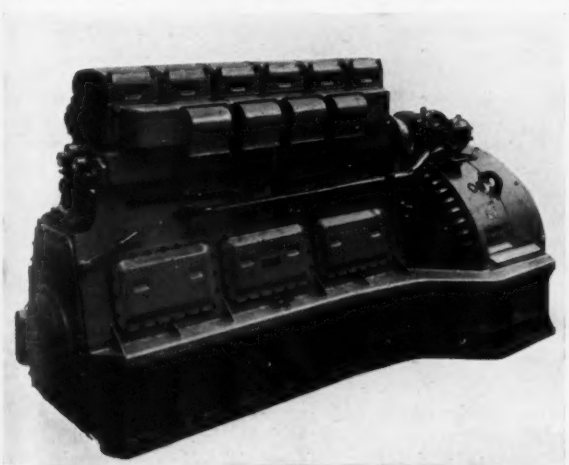
cylinder heads are of Saurer manufacture. The pump, like the camshaft, is gear-driven from the main shaft; a belt drive is used for the water pump and dynamo. For normal diesel-electric railcar applications a hydraulically-operated servo-governor is fitted to give five engine speeds including idling (400-450 r.p.m.) and full-load speed.

The 12-cylinder vee BZD engine is composed of two banks of BXD cylinders and mechanism set at 60 deg. to one another and mounted on a common crankcase, but the cylinder blocks are four in number, each comprising three cylinders which have cast iron dry-type liners inserted. The two inlet and two exhaust valves of all 12 cylinders are operated from one camshaft, located in the vee between the two banks and driven from the crankshaft by helical gears. The cylinder block, heads, and crankcase are all of cast iron. The crankshaft is of the usual Saurer type, and the rods of opposite cylinders are separate, one big-end being forked over the other; the side surfaces of the big-ends which rub against each other are chrome-hardened, and the big-end bearings are of lead-bronze. A one-hour rating of 330 b.h.p. is sometimes given to this engine, and a peak output of 360 b.h.p. at 1,500 r.p.m. has been attained. This engine, and the results of tests upon it, were described in the issue of this Supplement for November 29, 1935.

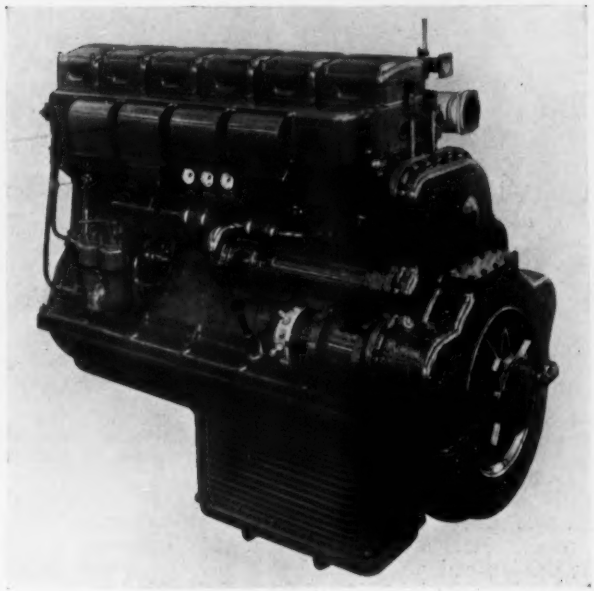
Sulzer

Within the last three years a new range of engines suitable for railcars, trains, and locomotives has been produced by Sulzer Bros., and built by them and by Armstrong-Whitworth for a wide variety of duties. Compared with the old Sulzer range, the new engines are characterised by lighter weight and higher speeds.

The engines used in railcar and train work up to the present time are the 6LF19 (Swiss Federal and Central Argentine Railways); 6LDT19 (Buenos Aires Provincial Railway); and 6LDT25 (South Manchuria Railway). The LF engines are for bogie mounting, and the LD and LDT types have incorporated a frame to take a generator, and are used for underframe mounting. The continuous rating of the 6LF19 engine is 260 b.h.p. at 1,075 r.p.m. and the maximum load 320 b.h.p. at 1,200 r.p.m. The 6LDT22 engine has not yet been used for railcars, although it is used in other applications. A development of the LD25 engine, which has given such good service in Argentina, is being installed in the two new Sao Paulo trains, but will be fitted with a Büchi supercharger to give an output of 600 b.h.p.; the normal maximum unsupercharged capacity is 450 b.h.p. at 750 r.p.m. The characteristics of the four sizes mentioned above are given in the accompanying table.



300 *b.h.p. Sulzer lightweight engine and its generator .*



290 *b.h.p. Sulzer railcar engine*

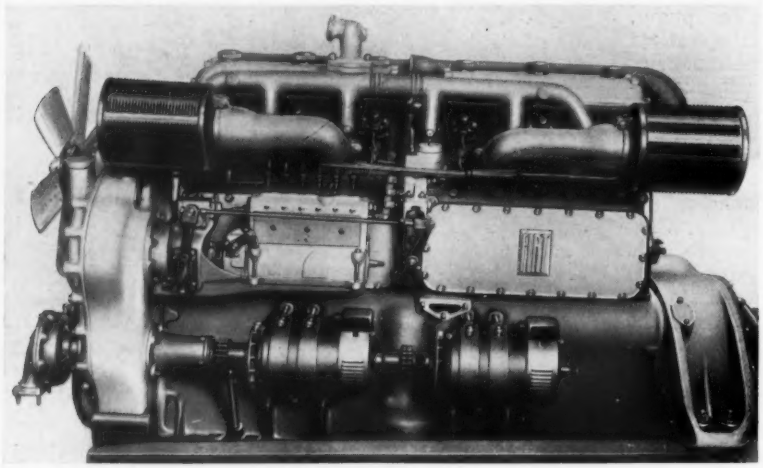
In both the LF and LDT types a combination of cast and welded steel construction is used to give great strength in conjunction with light weight—16 to 18 lb. per b.h.p. on the continuous rating. In the LF range the cylinder block is a single-piece casting incorporating the housings for the valve and fuel pump camshafts. It is bolted to a fabricated steel crankcase, the lower portion of which is designed to suit the three-point mounting. A large cast aluminium oil sump with outside cooling fins is bolted to the bottom of the crankcase.

The cylinder heads are independent and each houses one inlet and one exhaust valve and carries the rockers for valve operation. The valves are arranged down the longitudinal centre line of the cylinders. The injector is disposed centrally and the valve gear and injector are enclosed by a quickly-removable cover for each cylinder head. Lubricating oil is pressure-fed to the valve rocker fulcrums, and from thence through a passage in the valve rocker to the tappet rods, down which it runs to lubricate tappets, valve rollers, &c., and eventually drains into the oil bath for the camshaft and cams from which there is an overflow to the crankcase.

The pistons are of aluminium alloy with four compression rings, upper and lower scraper rings and fully floating gudgeon pins. The connecting rods have stepped small-end bearings and four-bolt big-end bearings, whitemetal-lined in bronze shells. Forced lubrication is applied to both ends. The single-piece crankshaft runs in seven main bearings, the caps of which are held down by bridge pieces cottered into the crankcase structure. The bearings employed are steel shells lined with whitemetal. The cam-

Sulzer Railcar Engines

Model	6LF19	6LDT19	6LDT25	6LD25
Speed, r.p.m.	1,200	1,175	900	750
One-hour output, b.h.p.	290	300	500	450
No. of cylinders	6	6	6	6
Bore and stroke, mm.	190 × 230	190 × 240	250 × 310	250 × 350
Weight, lb.	4,600	5,080	8,800	11,000
Fuel consumption at continuous rating, lb./b.h.p./hr.	0·40	0·39	0·39	0·39



Six-cylinder 145 *b.h.p. Fiat engine with a rated speed of* 1,700 *r.p.m. The continuous output is* 135 *b.h.p. at* 1,550 *r.p.m. A Ricardo combustion chamber is fitted*

shaft, placed high up on the cylinder block, is made in a single piece with hardened and ground cams and journals. It is driven by a train of helical gears from the driving end of the crankshaft and is mounted in a casing along the inlet side of the cylinder block.

In the LDT range also, the framework is formed of a combination of cast and welded constituents, the cylinder block being a casting and the crankcase of welded steel plate. The five inner transverse stays of the crankcase, which support the main bearings, are of welded steel plate, but the cross-members at each end, carrying the outer bearings, are steel castings welded to the crankcase. The cylinder heads are separate iron castings and are encased in separately-cast aluminium covers. Each cylinder head contains the inlet and exhaust valves and the central multi-hole fuel valve. As in the 6LF engine, there are valve and fuel pump camshafts on opposite sides of the cylinder bank, and the fuel pump itself is of the Bosch type (C.A.V.-Bosch in this country). The crankshaft and pins are hollow-bored and the shaft is carried on seven bearings with whitemetal linings on steel shells; the big-end bearings have whitemetal on bronze shells. The material used for the crankshaft is a special brand of carbon steel, but nickel steel is used for the connecting rods. The pressure lubrication system works normally at a pressure of about 25 lb. per sq. in., and the speed and fuel control arrangement is such that any failure in pressure will shut down the engine. The water jackets are arranged with a narrow annulus near the top, which produces a syphon action of the circulating water towards the cylinder head.

A full description of the 6LDT22 engine will be found in the issue of this Supplement for March 20, 1936, and of the 6LF19 engine in the issue of November 27, 1936. Tests undertaken by the Automobile Club of France on one of the 6LF19 engines showed that during a 72-hr. continuous test the fuel consumption averaged 0·40 lb. per b.h.p. hr. at full load and 0·402 lb. at three-quarter load; the minimum consumption was 0·39 lb. at 0·9 of full load. The lubricating oil consumption averaged 2·63 gr. per b.h.p. hr. It is worth noting that neither of the Swiss firms, Saurer and Sulzer, make eight-cylinder engines for railcar traction.

Fiat

There are four sizes of oil engines used for railcars and trains by Fiat, and they range from 75 to 400 b.h.p. on the continuous rating. They are used exclusively in vehicles made by the same firm, and all are bogie-mounted. The main characteristics are shown in the accompanying table. The 115 and 145 b.h.p. models have Ricardo cylinder heads and the 75 b.h.p. model has direct injection.

In the 115 b.h.p. model the cylinder block and crankcase are cast in one piece, of nickel-iron, but in the 145 b.h.p. size the cylinder block and crankcase are separate, the former being of cast iron with dry-type liners inserted, and the latter of light metal. The crankshaft is a one-piece forging of nickel-chrome steel, with hollow-bored pins; it is balanced by weights secured to half of the webs, and has a frictional vibration damper at the end remote from that carrying the auxiliary drives. The connecting rods are of nickel-chrome steel, and are driven through fully-floating gudgeon pins by Bohnalite pistons carrying four pressure and two scraper rings. The cylinder heads are cast in groups of three and each head contains one inlet and one exhaust valve operated from a chain-driven camshaft in the top of the crankcase. Bosch pumps and injectors are used, and are set for a pressure of 1,450 lb. per sq. in.; the compression ratio is 17 to 1. Electric starting is incorporated.

FIAT RAILCAR ENGINES

Model	355C	356	357	V1612
No. of cylinders	6	6	6	12
Maximum output, b.h.p.	80	115	145	550
Speed at maximum output, r.p.m.	1,700	1,800	1,700	1,800
Continuous output, b.h.p.	75	150	135	400
Speed at continuous output, r.p.m.	1,550	1,825	1,550	1,500
Cylinder bore and stroke, mm.	108 × 152	115 × 160	125 × 175	160 × 180
Weight, lb.	1,900	2,100	2,980	4,900
Fuel consumption at continuous rating, lb./b.h.p./hr.	0·403	0·48	0·44	0·44

Cast iron is used also for the combined cylinder block and crankcase of the 75 b.h.p. engine, which is built up on generally similar lines. Centrifugally-cast iron liners are inserted in the cylinder block. The camshaft, governor, and fuel pump are chain-driven; lubrication is by a gear-driven pump, and the oil circuit includes a double external filter, a pressure-regulating valve, and a safety valve. The crankcase of the 12-cylinder vee engine is of steel, as is the cylinder block, and the pistons are of a special aluminium alloy. The fuel pump is of Fiat design and manufacture and operates at a pressure of 4,000 lb. per sq. in. As with the rest of the Fiat range, these engines are totally enclosed.

Breda

The engines of the Soc. Italiana Ernesto Breda are built under licence from the Associated Equipment Co. Ltd., of Southall, and all are of the six-cylinder Ricardo-head type, developing 130 b.h.p. at 2,000 r.p.m., as described in the August 6 issue of this Supplement. The Italian

CHARACTERISTICS OF GANZ-JENDRASSIK RAILCAR OIL ENGINES

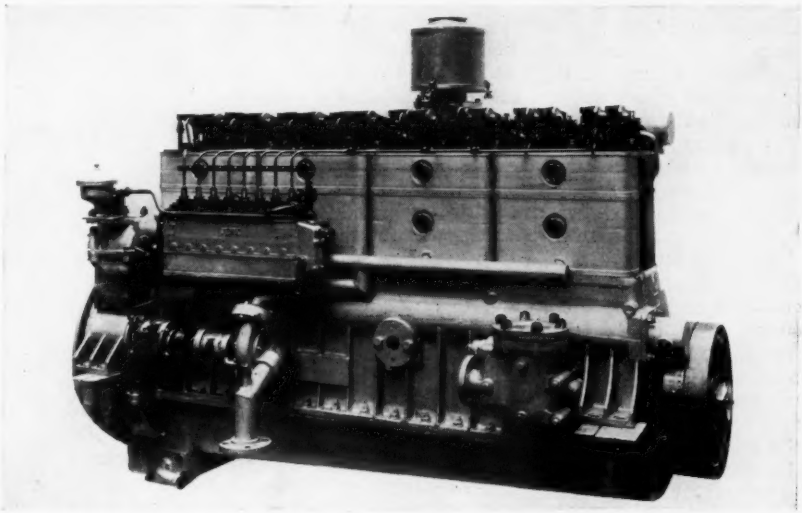
Type	VI JmR 150	VI JmR 160	VIII JmR 150	VIII JmR 160	VIII JaR 105	VI JaR 135	VIII JaR 135	VI JaR 170	VIII JaR 170
Number of cylinders	6	6	8	8	8	6	8	6	8
Bore and stroke, mm.	150×185	160×185	150×185	160×185	105×140	135×185	135×185	170×240	170×240
Continuous output, b.h.p.	110	125	145	165	96	120	160	240	365
Speed at continuous output, r.p.m.	1,000	1,000	1,000	1,000	1,650	1,300	1,300	1,250	1,250
Service maximum output, b.h.p.	120	138	160	180	110	150	200	275	400
Speed at service maximum output, r.p.m.	1,000	1,000	1,000	1,000	1,650	1,500	1,500	1,450	1,450
Weight, lb.	4,200	4,400	5,050	5,300	1,700	2,875	3,750	4,950	6,500

State Railways have given these engines a continuous rating of 115 b.h.p. at 2,000 r.p.m. All the engines built by Breda for the Italian State Railways cars are bogie-mounted. They have six cylinders with a bore and stroke of 4·53 in. by 5·59 in. and weigh about 13 lb. per b.h.p. They are used in conjunction with Vulcan-Sinclair fluid couplings and Wilson epicyclic gearboxes.

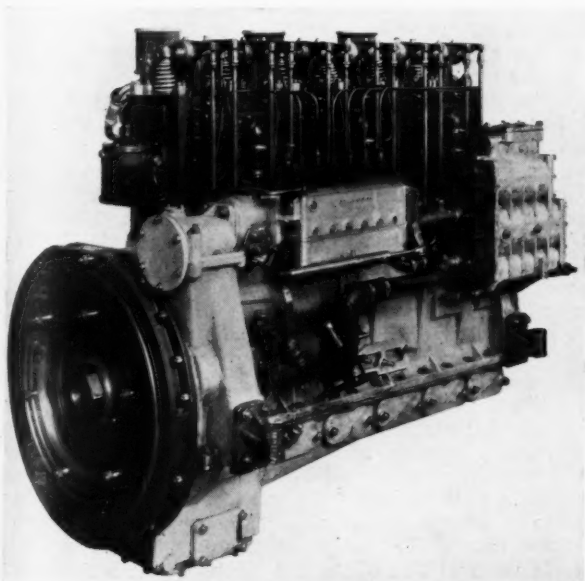
Ganz

In this case again practically the whole range of engines is for railcar work, and the engines vary from 96 to 365 b.h.p. in continuous rating. Additional to the large number of engines built at Budapest for Hungary, Spain, Egypt, Roumania, South America and elsewhere, others have been built by the licensees—Stork Bros. in Holland,

Right : 350 b.h.p. eight-cylinder Stork-Ganz engine as used in trains of the Netherlands Railways



Below : Metrovick-Ganz six-cylinder engine with a continuous rating of 240 b.h.p. at 1,250 r.p.m.



Carels in Belgium, Als-Thom in France, and Metro-Vick in England. Only six-cylinder and eight-cylinder engines are built. The Ganz engines were designed under the direction of Mr. George Jendrassik, and all of them incorporate precombustion chambers and the easy-starting method of a retarded opening of the inlet valve, thus creating a vacuum in the cylinder during the first part of the suction stroke, which heats the air considerably as soon as it is admitted. A special set of cams is provided for this purpose, and they are changed to normal setting as soon as the engine is firing. The oil engines used by Ganz for railcar work have the characteristics set forth in the accompanying table.

The JaR engines originally had a stroke of 220 mm. and when this was increased to 240 mm. the continuous output was increased from 220 to 240 b.h.p. in the six-cylinder engine and from 300 to 320 b.h.p., and sometimes to 365, and also (*e.g.*, in the Belgian triple-car trains), to 380 b.h.p. in the eight-cylinder engine. The continuous rating of the VIJaR 170 engine is 240 b.h.p. at 1,250 r.p.m. and the normal maximum 275 b.h.p. at 1,450 r.p.m., although a peak output of 310 b.h.p. at 1,450 r.p.m. has been reached. On the continuous rating the weight is under 20 lb. per b.h.p., the piston speed 1,800 ft. per min., and the brake m.e.p. 83 lb. per sq.

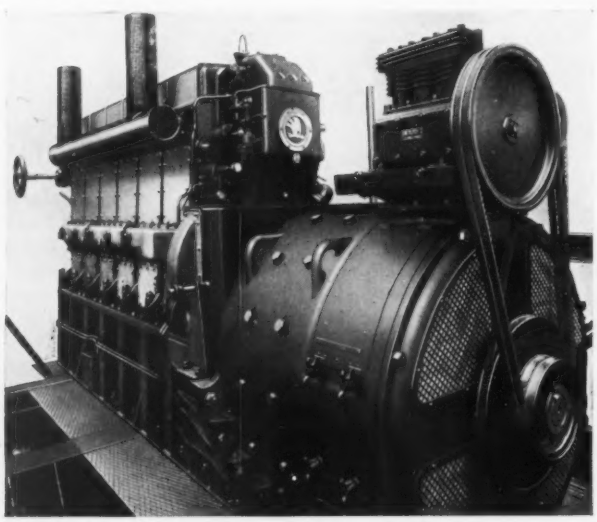
in. This is the engine which is used in the fast *Arpád* car of the Hungarian State Railways, the Metro-Vick car in this country, in Egypt, and in South America. The eight-cylinder engine can develop a peak output of 410 b.h.p. at 1,450 r.p.m.

In the present JaR170 engines with 240 mm. stroke, the crankcase is a light alloy casting carrying seven main bearings of lead-bronze and whitemetal. Above the crankcase are mounted three cast-iron cylinder blocks, each consisting of two cylinders, and above these again are the cast-iron cylinder heads, also cast in pairs. Each cylinder head contains one inlet and one exhaust valve driven by the usual rockers and push rods from a gear-driven camshaft located in the upper portion of the crankcase. There is a special dashpot balancing mechanism to eliminate any play between the rockers and the push rods. The cylinder heads have precombustion chambers.

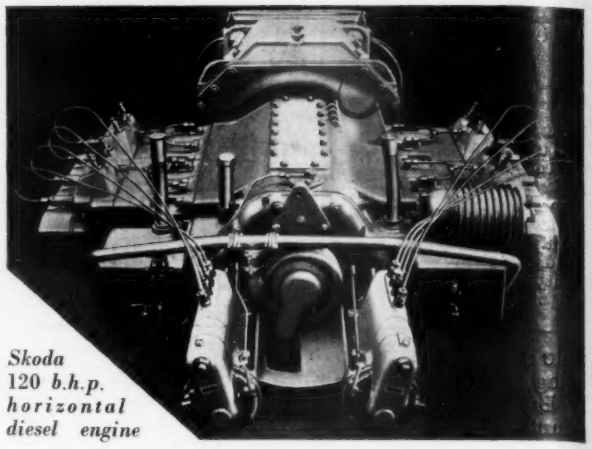
Aluminium pistons are used, and are connected through hollow gudgeon pins to forged steel connecting rods having bronze-bushed small ends and lead-bronze big ends. The balanced crankshaft is a single-piece forging of heat-treated alloy steel, and both the shaft and pins are hollow-bored. A frictional vibration damper is fitted at the forward end. Lubrication is by a gear-type pump, which forces the main oil stream through the hollow crankshaft to lubricate and cool the main and big-end bearings. From the big ends the oil passes through the drilled passage in the connecting rods to lubricate the gudgeon pins and to cool the pistons by spraying on their undersides. Other branches feed oil to the camshaft bearings, timing gears and other working parts. There is an oil cooler mounted on the engine and round this is circulated the engine cooling water after it has been through the radiator.

The fuel pump is of the Ganz-Jendrassik type, and is driven through a train of gears which also drive the governor and the cooling-water pump; the output of the engine is controlled by a variation in the stroke of the fuel pump plungers. A filter is fitted on one of the cylinder blocks through which the fuel passes on its way to the pumps. Starting of the engine is effected electrically. In addition to the starting motors, which are mounted on the crankcase, the engine drives through a belt a 24-volt dynamo which supplies the lighting and starting circuits of the railcar and engines.

It is probable that the good performance obtained from



400 b.h.p. six-cylinder Skoda engine used in heavy railcars in Czechoslovakia



Skoda 120 b.h.p. horizontal diesel engine

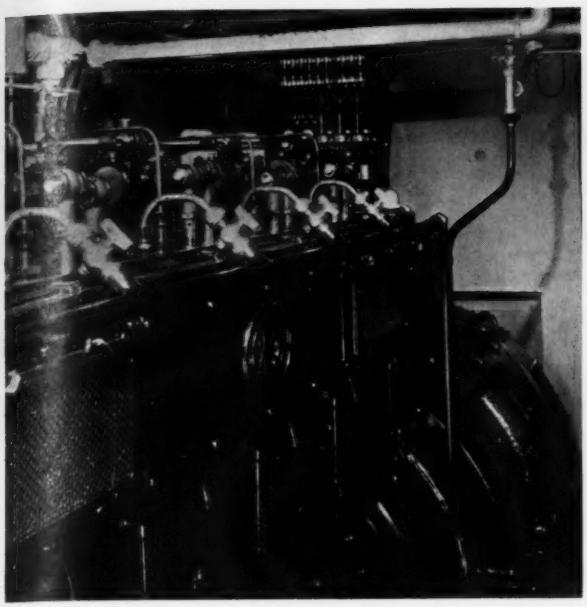
recent Ganz engines is due, in part at least, to the fact that Ganz undertake the full maintenance of most of their engines for a period after delivery; the very careful and detailed records which are kept show up at once any faults which may be recurrent, and enable them to be rectified.

Skoda

The Skoda works, of Pilsen, have built a variety of oil engines for installation in railcars of the Czechoslovak State Railways, principal among which are the 100 and 400 b.h.p. vertical engines and the 120 and 160 b.h.p. horizontal engines. The horizontal models were among the first of this type in the world to be adapted to railcar work. For new construction the 100 b.h.p. vertical size appears to have been superseded by the horizontal type.

Of the totally-enclosed type, the 400 b.h.p. engine is installed in heavy double-bogie railcars used for trailer haulage. It has six cylinders 230 mm. by 280 mm. and is rated at a continuous output of 400 b.h.p. at 1,000 r.p.m., with a one-hour capacity of 440 b.h.p. at the same speed, and a capacity of 480 b.h.p. for 15 min. At full-load full-speed the fuel consumption is 0·38 lb. per b.h.p.hr. and the lubricating oil consumption 4 gr. per b.h.p.hr. The cylinder block and crankcase are separate units, both fabricated of welded steel, and having individually cast iron heads above them. Cast iron liners are inserted in the cylinder block and in them run aluminium alloy pistons. The camshaft is located in the cylinder block and is gear-driven from the crankshaft; in addition to driving the main inlet and exhaust valves, it has cams for the operation of the six separate Bosch injection pumps, one for each cylinder. The injection valves in the cylinder heads are of Skoda's own type. The motion of the fuel pump cams is transmitted to the pumps through rocking levers supported eccentrically on a pre-injection shaft carried along the cylinder block; this shaft is slightly turned by the oil pressure and thereby automatically changes the beginning of the fuel injection period according to the rotational speed of the engine. The pressure-lubrication system is operated by two gear-driven pumps, but the water pump and the Jahns-Thoma governor are driven by Renold-Duplex chains.

With two opposing banks of four cylinders, the smaller horizontal engine develops its continuous output of 120 b.h.p. at a speed of 1,600 r.p.m. in cylinders 110 mm. by 150 mm.; the larger model gives 160 b.h.p. at the same speed in eight cylinders 125 mm. by 160 mm., and has a top output of 180 b.h.p. at 1,700 r.p.m. Idling speed is 550 r.p.m. The weight of the 120 b.h.p. engine is 1,925 lb., and that of the 160 b.h.p. engine is 2,700 lb.;



350 *b.h.p. Ceskomoravska-Kolben-Danek railcar oil engine*

the fuel consumption of both is 0·44 lb. per b.h.p.hr. at full load. A turbulence chamber is fitted in each cylinder head, and two four-ram Bosch pumps are fitted at one end of the engine. As is usual in modern horizontal engines, the nickel-chrome steel crankshaft is balanced by prolongations of the crank webs, but an uncommon feature is that the five main bearings of the crankshaft are of the roller type. The crankcase is separate from the cylinder banks, and is of cast iron, although examples with cast steel cases have been built; the cylinders themselves are of nickel cast iron, and they contain aluminium alloy pistons.

C.K.D.

The Ceskomoravska-Kolben-Danek company also makes small horizontal and large vertical engines. Although of the same continuous output (160 b.h.p.) as the Skoda machine, the C.K.D. horizontal model is of a heavier type, weighing 4,100 lb., and runs at 1,200 r.p.m. on the continuous rating. The maximum load is 175 b.h.p. at 1,350 r.p.m., and the idling speed is 650 r.p.m. The 150 mm. by 180 mm. cylinders have pre-combustion chamber heads and Bosch fuel injection equipment; the crankcase is of welded steel plate and the cylinders have steel liners in which run aluminium alloy pistons. Both the crankshaft and big-end bearings are of the plain type. The fuel consumption at full-load full-speed is 0·415 lb. per b.h.p.hr.

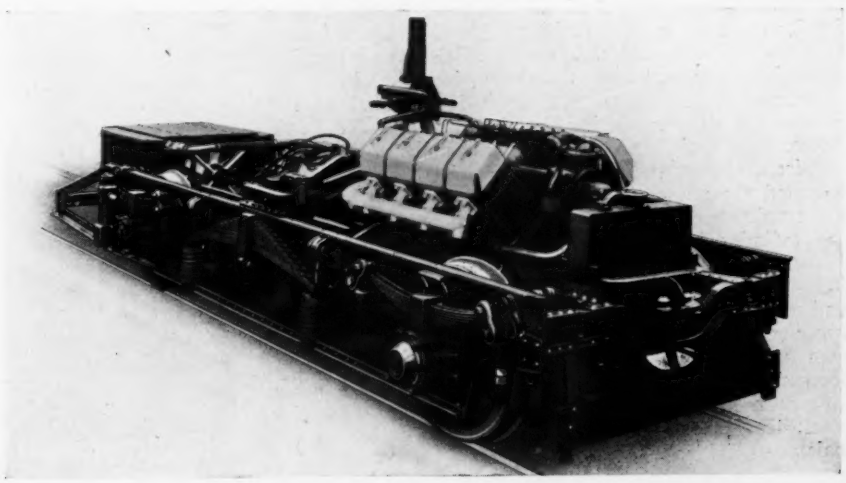
In the large vertical range, C.K.D. in 1932 produced a six-cylinder engine having a continuous output of 300 b.h.p. at 800 r.p.m., and a 5-min. overload capacity of 400 b.h.p. at 1,000 r.p.m. For that time the construction was very advanced. The crankcase and cylinder block were made up of welded steel, and the cylinder heads, each with two inlet and two exhaust valves, were cast individually of an aluminium alloy. Each cylinder had its own individual fuel pump. The weight was only 17½ lb. per b.h.p. on the continuous rating, and it would appear that this was too light for the knowledge and experience then available, for further engines built from 1934 onwards have been considerably heavier.

The present 350 b.h.p. engine, as installed in the Blue Arrow and other express railcars working heavy services on the Czechoslovak State Railways, weighs 9,600 lb., equivalent to 27½ lb. per b.h.p. The continuous rating of these engines is developed in six cylinders 220 mm. by 280 mm. at a speed of 900 r.p.m., and the top output is 380 b.h.p. at 1,000 r.p.m. Proposals have been made for the construction of an eight-cylinder engine of the same type to give 450 b.h.p. continuously. At normal full load the fuel consumption of the present engines is 0·39 lb. per b.h.p.hr., and at half-load has risen to 0·44 lb.; the lubricating oil consumption averages 5 gr. per b.h.p.hr. The combustion system is of the Hesselman type, and the fuel is injected by Bosch pumps through Bosch nozzles. There are two inlet and two exhaust valves per cylinder, operated by separate camshafts. The main and big-end bearings are of the plain type with whitemetal linings, and both the crankshaft and connecting rods are of nickel-chrome steel.

B.K.P. and Simmering

The Brno-Kralova-Polska works make three sizes of eight-cylinder vee engines with an angle of 90 deg. between the two banks, and these engines also are made under licence in Austria by the Simmeringer Waggon-und Maschinenfabrik, and installed in diesel-electric cars on the Austrian Federal Railways.

Cylinders 130 mm. bore by 160 mm. stroke are used in the smallest model, which has a continuous rating of



160 *b.h.p. eight-cylinder Simmering B.K.P. diesel engine mounted in the bogie of one of the diesel-electric railcars of the Austrian Federal Railways*

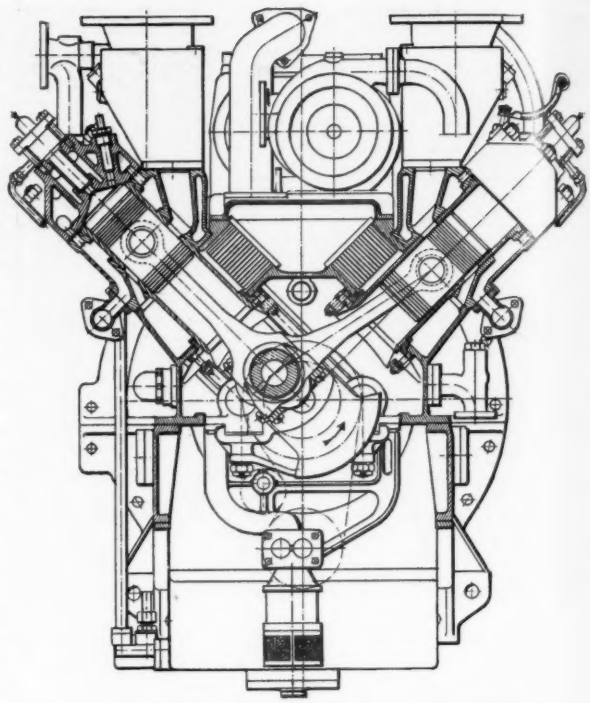
150 b.h.p. at 1,500 r.p.m. and a maximum rating of 165 b.h.p. at 1,600 r.p.m.; the idling speed is 550-600 r.p.m. The weight is about 3,700 lb. and the full-load fuel consumption 0·407 lb. per b.h.p.hr. The intermediate size has 140 mm. by 180 mm. cylinders, and is rated at 160 b.h.p. at 1,300 r.p.m. continuously, with a peak output of 175 b.h.p. The injection is direct, through Bosch equipment with a single nozzle located at the side of the cylinder. The rods of opposite cylinders are separate, but work on the same crankpin, one rod being forked over the other. Both the crankpins and the shaft are hollow-bored, but the latter only to a small extent. With a cast-iron crankcase the engine weight is about 4,400 lb.

The largest model has 150 mm. by 190 mm. cylinders and is rated at 210 b.h.p. at 1,200 r.p.m. continuously, with a short-time rating of 230 b.h.p. at 1,320 r.p.m. In certain installations a continuous output of 210 b.h.p. at 1,350 r.p.m. has been fixed. The weight varies between 4,850 and 5,300 lb. for engines built in Czechoslovakia and Austria, but one or two built in Poland with a framework wholly of cast iron weigh about 6,100 lb. The full-load fuel consumption is 0·407 to 0·415 lb. per b.h.p.hr. Precombustion chamber cylinder heads are used in conjunction with Bosch fuel pumps and nozzles, and, like the cylinder blocks, are cast in groups of two. The two fuel pumps are located in the vee, and just below them is the single camshaft, gear-driven from the main shaft. Normally, the crankcase is a single-piece silumin casting. Wet-type liners are inserted in the cylinder blocks. In the Simmering engines the crankshaft is a special nickel-chrome-molybdenum steel, Duro-hardened, and it is carried in bearings having a whitemetal lining on bronze shells; it is balanced by weights bolted to the crankwebs. Aluminium pistons are used in all makes, and they carry four pressure and three scraper rings. The big-ends of the nickel-chrome steel rods have lead-bronze bearings and the small ends Carobronze bushes.

Grazer

The engines built by the Grazer Waggon-und Maschinenfabrik have so far been applied only to freight railcars, which in their characteristics and duties are not unlike locomotives. These vehicles are the 300 b.h.p. cars of the Austrian Federal Railways, as described in the issue of this Supplement for October 6, 1933. Although these engines are not nearly so weighty per unit of output as the old 200 b.h.p. Grazer-Hesselman engines installed in small diesel locomotives from 1927 to 1930, no special effort has been made to cut down the weight, which is about 25 lb. per b.h.p.

The continuous output of 300 b.h.p. at 1,000 r.p.m. is developed in six vertical cylinders 210 mm. by 250 mm.; a short-time rating of 330 b.h.p. at the same speed is allowed. The crankcase is a single-piece silumin casting incorporating the sump, and on it is mounted another single-piece silumin casting forming the cylinder block. Above this again are the individual cylinder heads, of cast iron, each containing one inlet and one exhaust valve operated from a camshaft located in a chamber outside the crankcase. Cast iron wet-type liners are inserted in the cylinder block, and in them run aluminium-alloy pistons having five pressure and two scraper rings. The fully-floating gudgeon pins are unusual in that large brass end plugs are used, and are tied together by a small bolt running through the hollow pin. Each cylinder has its own fuel pump of the Grazer type, and the injection into the combustion space is through a multi-hole Bosch nozzle. The connecting rods and crankshaft are of nickel-chrome steel; the shaft is hollow-bored throughout, but has no balance weights. It is carried in seven bearings lined with a tin-base whitemetal, whereas the big-end bearings have lead-bronze linings.



Section through new Atlas two-stroke engine

Ebermann

This is the only wholly Polish railcar oil engine, and is installed in a few cars belonging to the Polish State Railways. It is a six-cylinder four-stroke engine arranged in vee formation, with three cylinders set in each bank at an included angle of 90 deg. The crankcase and cylinder blocks are in an integral casting, and have cast iron wet-type liners pressed in. The 180 mm. by 250 mm cylinders give a continuous output of 200 b.h.p. at 800 r.p.m. on a weight of 3,450 lb. At full-load full-speed the fuel consumption is 0·42 lb. per b.h.p.hr., and at three-quarter load 0·408 lb. The fuel pump and camshaft are in the neck of the vee. Two connecting rods work on each crankpin, and as they are neither forked nor articulated, the opposite cylinders are slightly offset relative to one another.

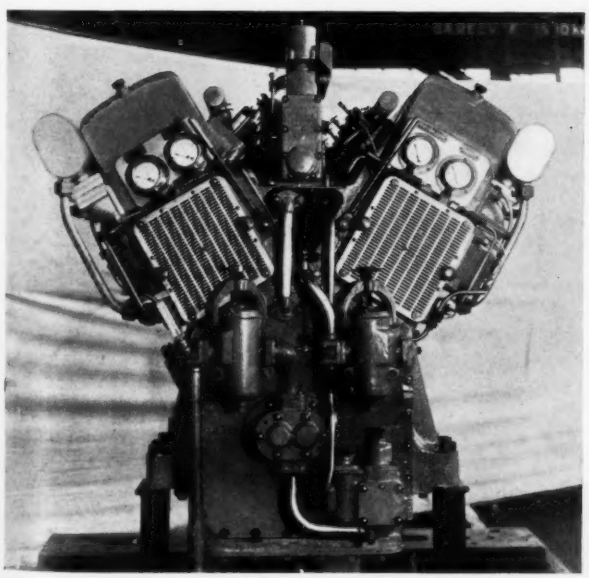
Atlas

The first successful railcar oil engines in the world were those installed in small Swedish railcars from 1913 onwards. The original six-cylinder four-stroke engines developed 75 b.h.p. at 550 r.p.m., but after some years of experience the rating was raised to 90 b.h.p. This model was of the vertical type, as was the first 120 b.h.p. engine, but after the war the type was developed into six-cylinder vee, eight-cylinder vee 200 b.h.p., and 12-cylinder vee 300 b.h.p. engines running at 550 r.p.m. and weighing 55 to 60 lb. per b.h.p.

Last year a new 12-cylinder high-speed light-weight two-stroke engine with port scavenging was introduced by Atlas; it has a continuous output of 200 b.h.p. at 1,800 r.p.m. and a half-hourly loading of 225 b.h.p. at the same speed. The cylinders are 95 mm. by 130 mm. and are arranged in the usual two banks with an angle of 90 deg. between. Injection is direct, through a Bosch pump and a single atomiser in the centre of a plain conical

Integrally-cast cylinder heads and liners, pistons connecting rods, and valve boxes of six-cylinder two-stroke Burmeister & Wain engine developing 260 b.h.p. at 1,200 r.p.m.

combustion chamber. Heating coils are fitted to six of the cylinders. The crankcase is in two portions, divided just below the centre-line of the shaft; the upper portion is a silumin casting incorporating the lower half of the cylinder blocks of both banks. Above these are mounted the cast iron cylinder blocks proper, and wet-type liners are inserted and are fitted into both the blocks and the upper portion of the crankcase. In the angle between the cylinder banks is the scavenging receiver, the automatic scavenging valves, the rotary blower (running at twice the engine speed), the water pump, the fuel pump, and the governor. All the pumps are driven from the main shaft by gears. The combustion and inertia loads are taken up by tie-bolts arranged in a patented vee form. The six-throw hollow-bored crankshaft, with balance weights formed by prolongations of the webs, is mounted from below. In the early running experiments a torsional vibration damper was fitted, but was found to be unnecessary. At full-speed full-load the fuel consumption is 0·43 lb. per b.h.p.hr., and at the half-hour rating, 0·45 lb.; the lubricating oil consumption is 2·5 to 3·0 gr. per b.h.p.hr. A generally similar eight-cylinder engine of 135 b.h.p. is available also.



400 b.h.p. Frichs 12-cylinder engine

Burmeister & Wain

All the Burmeister & Wain engines are of the vertical two-stroke type, and the general features of construction were detailed in the August 6 issue of this Supplement when the Harland & Wolff engines were described. The original B. & W. two-stroke railway oil engines had the exhaust controlled by small pistons located above the main pistons and moving in an opposite direction to them; these auxiliary pistons, or piston valves, were operated by an eccentric on the main crankshaft. This arrangement has been given up in favour of a cam-operated valve in the cylinder head, the scavenging air, as before, being admitted through circumferential ports round the cylinder walls. The blower drive is now through gears, whereas it used to be by a roller chain.

Frichs

Six different six-cylinder railcar engines of modern design are now made by Frichs and by that firm's licensees, such as the Vulcan Foundry Limited in this country. In addition, there is a 12-cylinder engine used in fast trains.

The railcar engines have continuous outputs of 60 b.h.p. at 1,800 r.p.m. in cylinders 100 m. by 130 mm.; 82 b.h.p. at 1,400 r.p.m. in cylinders 115 m. by 170 mm.; 115 b.h.p. at 1,200 r.p.m. in cylinders 135 mm. by 200 mm.; 150 b.h.p. at 1,100 r.p.m. in cylinders 155 mm. by 220 mm.; 220 b.h.p. at 1,000 r.p.m. in cylinders 175 mm. by 260 mm.; and 250 b.h.p. at 1,000 r.p.m. in cylinders 185 mm. by 260 mm. The 12-cylinder vee engine has a continuous output of 400 b.h.p. at 1,250 r.p.m. and a top capacity of 440 b.h.p. The bore and stroke are 165 mm. and 200 mm. respectively, and the weight about 8,000 lb. The fuel consumption at full-load full-speed is 0·418 lb. per b.h.p.hr., and the fuel is injected by a Bosch pump through Frichs nozzles.

Weights of 15½ to 17½ lb. per b.h.p. on the continuous ratings are found in the six railcar models, the general features of all of which are similar. The crankcase is a single casting of an aluminium-silicon alloy and is surmounted by a cast steel cylinder block containing wet-type cast iron liners. The crankshaft is carried in bearings having whitemetal lining on steel shells, but the big-end bearings have whitemetal on bronze shells. The cast iron cylinder heads contain one inlet and one exhaust valve each, operated from a camshaft inside the crankcase.

THE RICARDO COMBUSTION SYSTEMS

THE Berliet engine, described in our October 1 issue (p. 583), is now made only with one or other of the Ricardo cylinder heads, the Acro type as used in the first P.L.M. cars and mentioned in our article, having been given up. The Ricardo combustion systems are now made in three models, viz., *Comet Mark II, Comet Mark III,* and *Whirlpool,* and licences for these systems have been granted to the following engine makers, who have produced well over 2,000,000 b.h.p. of engines so fitted.

Albion Motors Limited.
W. H. Allen Sons & Co. Ltd.
Armstrong Siddeley Motors Limited.
Associated Equipment Co. Ltd.
Bergius Co. Ltd.
S.A. Automobiles Berliet (France).
Bolinder-Munktell, A.B. (Sweden).
Soc. It. Ernesto Breda (Italy).
Brooke Marine Construction Co. Ltd.
S.A. Brossel Frères (Belgium).
Peter Brotherhood Limited.
Ceskomoravska Kolben-Danek (Czechoslovakia).
S.A. Chenard et Walcker (France).
S.A. Andre Citroen (France).
S.A. John Cockerill (Belgium).
Crossley Bros. Ltd.
Crossley Motors Ltd.
Davey, Paxman & Co. (Colchester) Ltd.
De Havilland Aircraft Co. Ltd.
Dennis Bros. Ltd.
W. H. Dorman & Co. Ltd.
S.A. Fiat (Italy).
S.A. Gnome et Rhone (France).
Ingersoll Rand Company (U.S.A.).
R. A. Lister & Co. Ltd.
Maschinenfabrik Augsburg-Nürnberg, A.G. (Germany).
Mirrlees Bickerton & Day Limited.
D. Napier & Son, Ltd.
Ruston & Hornsby Limited.
Maschinenfabriek Gebr. Stork N.V. (Holland).
Tangyes Limited.
Thomassen & Company (Holland).
J. I. Thornycroft & Co. Ltd.
Vickers Armstrongs Limited.
Waukesha Motor Company (U.S.A.).

The Ricardo Comet combustion system emerged in substantially its present form in 1930, largely as the outcome of research work carried out on behalf of the Associated Equipment Co. Ltd. The following essential requirements became evident from this early experimental work coupled with the A.E.C.'s own experience of a few compression ignition engined vehicles in London service; these early engines embodied the Acro combustion system.

(1) An ability to operate over a speed range closely comparable with that of the equivalent petrol engine.

(2) Complete freedom from exhaust smoke or smell even under conditions involving long spells of light running as at traffic stops, &c.

(3) Freedom from combustion knock, particularly when accelerating against load.

(4) The ability to use the pintle type of self-cleaning single hole nozzle.

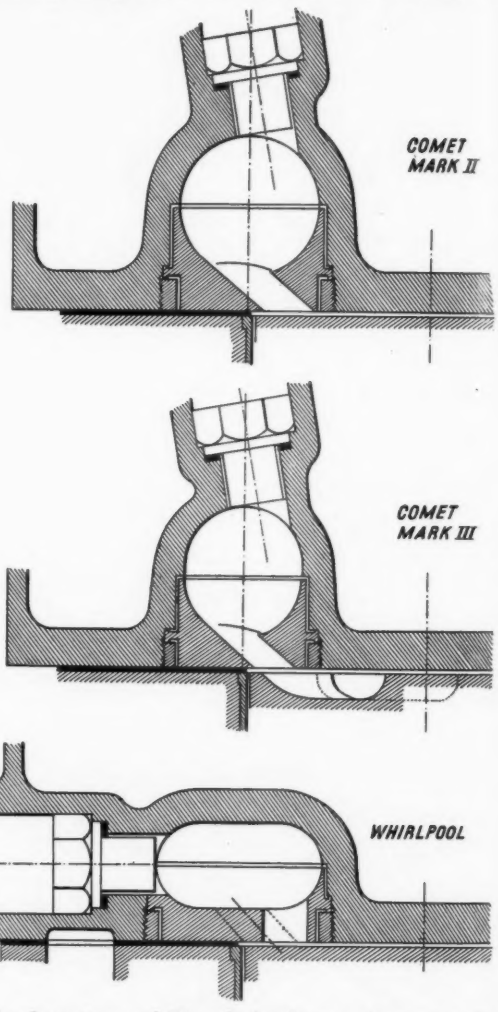
(5) Insensitiveness to a variety of fuels having a wide range of ignition characteristics.

(6) The ability to dispense entirely with either a manually or mechanically operated timing device for the fuel injection pump; such devices early showed themselves open to severe abuse and to be mechanically weak.

The general lines of reasoning followed in perfecting the system in such a way as to meet all the requirements, can be set out as follow:

The consideration of speed made it imperative to keep available for valve area the whole diameter of the cylinder bore. The centrally disposed injector, already under a cloud as necessitating the use of a multi-hole nozzle was thus, at one step, ruled out.

Given adequate breathing area, the other important factor in ensuring smoke-free combustion and a high mean effective pressure up to high engine speeds, was a very intense relative movement between the air and the injected fuel. Since the generation of anything approaching an adequate swirling movement of the air on the induction stroke to permit of the use of a single hole nozzle could be shown experimentally to involve a serious drop in volumetric efficiency at high speeds, attention was turned to the generation of intense but orderly air movement during the compression stroke. One of the fundamental difficulties in the generation of air swirl during compression has always been the relatively high heat losses involved resulting from the necessary coincidence of high gas velocity with the time of high temperature both during the compression and, to a far greater degree, during the subsequent expansion stroke. Considerable attention was brought to bear on this difficulty, as a result of which the use of a heat insulated member was examined and investigated experimentally.



The three types of Ricardo heads now in current use

This member had formed in it the swirl generating tangential passage between the cylinder and the combustion chamber, of which it formed the lower half. So encouraging were the results obtained from this line of development, that it became clear that the reduction in heat loss resulting from the use of an insulated member,

coupled with the very intense and orderly air swirl thus made available, made possible the realisation of an extraordinarily high combustion efficiency which was virtually independent of engine speed. The heat insulated member also proved to be of the greatest value in meeting other of the conditions set out above.

The objectionable odour in an oil engine exhaust can be shown to result from the formation of aldehydes under conditions of light load when the combustion flame is small, weakly, and otherwise unstable. The quenching, or partial quenching, of this flame by its contact with the relatively cold surfaces of the combustion chamber, is responsible for the aldehyde formation and consequent pungent exhaust odour usually, but not always, accompanied by bluish-white smoke in the exhaust. The presence of the heat-insulated throat member through which all the fuel injected must pass in a burned or partially burned state, and which, even under light load or idling conditions, maintains a mean temperature far in excess of that of the water-cooled combustion chamber walls, effectively overcomes this difficulty. Yet another function of the hot throat member is to act in a regenerative capacity and to give up heat acquired during one expansion stroke to the air charge passing through it on the subsequent compression stroke. The effect of this is to raise the final temperature and pressure at the end of the compression stroke to a figure above that which would correspond normally to the compression ratio used. The amount by which the final temperature exceeds that based directly on the compression ratio depends upon the mean temperature of the hot member, which in turn, varies directly and considerably with speed and load, since its loss by radiation and conduction varies but little.

Ignition Delay

The margin by which the available temperature at the end of the compression stroke exceeds the self ignition temperature of the particular fuel, controls the delay period, or time lag, between the entry of the fuel and the commencement of burning. It becomes possible by the use of a heat-insulated member so to adjust the period of delay at various speeds and loads as to maintain it almost constant in terms of crank angle throughout the whole speed range of the engine. Again, the rate of burning of the second stage of combustion is proportional to the velocity of the air movement. This in turn varies directly with crankshaft speed. Thus both the delay angle and the subsequent rate of pressure rise remain constant throughout the whole range of speed, providing a form of automatic injection advance which by suitable proportioning and heat insulation of the throat member, can be given any desired speed characteristic. Thus it is possible without any change in injection timing, to provide that the maximum pressure shall remain constant at all speeds or, if desired, it may be given a slightly rising or slightly falling characteristic with speed.

The main source of combustion noise in an oil engine is the rate of change of pressure rise during the transition from compression to combustion, which in turn, depends largely upon the proportion of the total fuel charge in the combustion chamber at the time when inflammation starts.

Taking the extreme case, where the whole of the fuel charge even at or near full load has been injected before there is any burning, it is clear that when burning finally starts, it is entirely uncontrolled and uncontrollable. Looked at in another way, the shorter the delay between the time of the beginning of fuel injection and the start of combustion, the larger will be the proportion of the total quantity of fuel injected which will burn under control of the rate at which it is injected. Thanks to the high temperature reached in the Ricardo systems at the end of the compression stroke, there is a sufficient margin of heat available to ensure a very short delay period, even at high speeds, with the result that the rate of change of combustion is gradual and, what is more important, is directly controllable during the greater part of the fuel injection period, by the rate of fuel injection.

The different Ricardo combustion systems now in current use in various types of engines and their particular characteristics, are described below.

Comet Mark I System.—This was the original Ricardo Comet system developed some six years ago; it gave very satisfactory results in the hands of several licensees. The great advantages realised in the *Mark II* system have made the *Mark I* obsolete, and it is now no longer produced.

Comet Mark II.—This is the current system which is in use at the present time among some 30 licensees. It differs from the *Mark I* arrangement in that the axis of the injector passes downstream of the sphere centre by an amount equal to approximately one-third of the sphere radius. (See accompanying illustration.)

Comet Mark III.—The development of this system arose as a result of a serious increase in the price of gas oil in England, and is an effort to counteract this by an improvement in thermal efficiency. Approximately one-half of the total clearance volume is contained within the spherical chamber, and the other half is located in a specially formed depression in the piston top; the total heat losses to water and pumping losses are substantially reduced, without any sacrifice of the good distribution of the fuel in the swirl chamber. Actual test results have shown this system to give a slightly superior maximum power performance, as compared with the *Mark II* system, particularly at high speeds, while the fuel consumption is reduced by as much as 8 per cent. to 10 per cent. A constructional advantage of this system is that the reduction in sphere diameter allows for more generous water spaces between the combustion chamber and the valve ports, where heat stresses are most concentrated. From the point of view of combustion noise and ability to start there is a slight advantage as compared with the *Mark II* system.

Whirlpool.—In this system as much as possible of the total clearance volume is concentrated in the combustion chamber itself as in the *Comet Mark II*. The combustion chamber is not spherical, but is flattened in shape, having its major diameter on a horizontal plane. Air swirl is generated during the compression stroke in this chamber about a vertical axis by the provision of two holes in the loose throat piece. In plan the holes are disposed at 90 deg. to each other around the vertical axis. No advantage is to be gained by displacing the axis of the injector downstream of the centre of the combustion chamber.

The outstanding advantages of this system as compared with either the *Comet Mark II* or *Mark III* are good starting from cold, smoothness of running and the large range of fuels on which it will operate satisfactorily. A slight constructional disadvantage is that for the same combustion chamber volume, the flattened shape necessitates a larger diameter about the vertical axis. This, in turn, means that for the same size of cylinder, the combustion chamber encroaches further into the head space available for water.

RAILCAR PATRONAGE.—Since they began operation earlier this year the fast railcars of the French Eastern Railway have been well patronised. Taken over the whole time, the Paris-Strasbourg car has had 40 to 70 per cent. of its seats occupied; the Paris-Langres car, 90 to 100 per cent., and the Nancy-Belfort car, 100 per cent.

NOTES AND NEWS

G.W.R. Railcar Mileage.—The winter timetables of the Great Western Railway show that the 18 A.E.C. diesel-mechanical railcars are responsible for 3 per cent. of the total passenger train mileage of the company.

Southern Railway Diesels.—The three 350 b.h.p. diesel-electric shunting locomotives with English Electric oil engines and electric transmission are now in service at Norwood, where opportunity is being taken to train a number of drivers in their operation.

Italian Diesel Traction.—A complete service of single class diesel cars now caters for the passenger traffic on the Catania-Caltagirone and Potenza-Salerno lines of the Italian State Railways, and proposals are on foot to introduce similar services on the Cremona-Piacenza, Cremona-Fidenza, and Cremona-Brescia lines.

Trials in Jugoslavia.—Experimental runs were conducted recently on the Belgrade-Kraljevo line of the Jugoslav State Railways with Fiat and Breda diesel-mechanical railcars, and top speeds up to 80 m.p.h. were recorded. It is reported that Italian firms are endeavouring to negotiate an important order for railcars.

Twin Zephyr Accommodation.—The 1,800 b.h.p. seven-car Twin Zephyrs operating the 66-m.p.h. service between Chicago and the Twin Cities have had an eighth coach inserted in the rake. This is a 16-seater "dinette" car located just ahead of the dining car proper; the meals are served direct from the kitchen in the adjoining car.

Jugoslav Extension.—Ganz, of Budapest is building in conjunction with the First Jugoslav Railway Carriage Works, seven three-car diesel-mechanical trains for service on the narrow-gauge (760 mm.) division of the Jugoslav State Railways between Belgrade, Sarajevo, Mostar, and Dubrovnik. Each train is to consist of a 240 b.h.p. railcar at each end and a trailer in the middle.

More N.S.W. Diesels.—The New South Wales Government Railways have ordered two Leyland 130 b.h.p. oil engines for installation in light single-engined railcars fitted with multiple-unit control. As far as possible the extraneous connections and mounting details will be interchangeable with the Leyland petrol engines already operating in bogie railcars on the N.S.W. lines.

Multiple-Unit Control in France.—The De Dietrich works have been running experimentally three of their double-engined 320 b.h.p. diesel-mechanical railcars coupled in multiple-unit and operated by one man. Previously the double-bogie De Dietrich cars had been equipped for solo operation only, but 15 railcars built this year for the Etat, P.L.M., and Est systems have multiple-unit control.

U.S.A. Main-Line Locomotives.—The celebrated Capitol Limited express of the Baltimore & Ohio Railroad is now worked in each direction over the 773 miles between Chicago and Washington by the 3,600 b.h.p. diesel-electric locomotives as described in the issue of this Supplement for April 16 and July 9 last. The two existing locomotives are to be supplemented by two others within the next few months.

Spanish Railcars.—An order of the State Technical Junta, published in the *Official Bulletin* issued from Burgos on July 31 re-establishes a ministerial order of March 15, 1935, relating to the acquisition of railcars, and authorises the companies to acquire cars and charge to working expenses the interest and depreciation. It is reported that two Belgian-built cars have already been supplied to the Norte and M.Z.A. systems.

Diesel Traction Paper.—In the current issue of the *King's Engineer*, the journal of the Engineering Society of King's College, London, appears an interesting article by Mr. H. B. Calverley on the applications and possibilities of diesel-electric traction. This paper was awarded the third prize of the King's College Engineering Society. Mr. Calverley is the son of Mr. J. E. Calverley, Chief Engineer and Manager of the Traction Department of the English Electric Co. Ltd.

British Horizontal Engine.—Tillings-Stevens Limited has brought out an 8-cylinder horizontal oil engine developing 110 b.h.p. at 1,650 r.p.m., and intended mainly for road work. It has C.A.V.-Bosch injection equipment. An engine of this type is to be on view at the Commercial Motor Exhibition to be held at Earls Court from November 4 to 13. The applications up to the present have been in conjunction with a Maybach seven-speed preselective gearbox.

Roumanian Fast Diesels.—The Roumanian State Railways have introduced fast diesel railcars between Bucharest and Constanza and Bucharest and Brassov to accelerated schedules. The services are being operated with double-bogie vehicles built by the Malaxa car works and having Ganz engines and mechanical equipment. Only one class of accommodation is provided, and seat tickets are needed by all passengers. Speeds up to 75 m.p.h. are allowed on certain sections of the line.

South African Railcars.—The 1937-38 budget of the South African Railways and Harbours contains an allowance of £12,000 under the Capital and Betterment Estimates for the purchase of railcars. Mr. O. Pirow, the Minister of Railways, has stated that branch line passenger services are likely to be augmented in the near future by the introduction of cars operated on cheap fuel oil, and that this decision was taken after the visit to Europe of several technical officers, who obtained first-hand information in regard to the latest railcar developments.

Diesels in India.—Writing in the September issue of *Indian Engineering*, Sir Henry Freeland, one-time agent of the B.B.C.I.R., says: "We believe that in many cases the railcar is a good substitute for the steam-hauled train and we think that the diesel-engined railcar offers the best advantages. Then let us try them, expensive as they are. They probably will not suit all conditions, but to have practical knowledge of their performance on the rail will be all the more useful when it is remembered that railways will in all probability be given powers to go on the roads and operate their own buses and lorries."

Railway Engineering Prizes.—Every fourth year the Verein Mitteleuropäischer Eisenbahnverwaltungen awards prizes for inventions and papers of great value in railway engineering. Prizes awarded this year include one of 1,500 RM. for the development of the Flying Hamburger, one of the same amount to Mr. George Jendrassik for his invention and perfecting of the Ganz-Jendrassik railway oil engine, and another of the same value to Mr. Imre Job, of Ganz, for his invention of the Ganz railcar bogie, which was illustrated in great detail in our issue of September, 1935, and also dealt with subsequently, notably when describing the Metro-Vick-Cammell railcar in the issue of July 9 of this year.